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AFATL-TR-75-87, VOLUME II

6 EXTERNAL STORE AIRLOADS PREDICTION TECHNIQUE.

VOLUME II. DETAILED DATA.

BOOK 3. MER CARRIAGE SIDE FORCE AND YAWING MOMENT PREDICTIONS.


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AIR FORCE ARMAMENT LABORATORY

AIR FORCE SYSTEMS COMMAND • UNITED STATES AIR FORCE

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SECTION IV

MER CARRIAGE AIRLOAD PREDICTION

The technique for predicting the airloads of a store carried on a multiple ejector rack (MER) is presented in this section. The approach consists of inserting the MER/store configuration into the flow-field of the base wing (45° sweep) as outlined in Subsection 2.3 to obtain an initial prediction for the side force, yawing moment, normal force, and pitching moment components for the two rack centerline stations (MER stations 1, 2). The MER shoulder stores are treated as increments to be added to the initial predictions made for MER stations 1 and 2 for these four components. The rolling moment and axial force components are predicted in a manner similar to that used for the single carriage predictions.

The method contained in this section has been developed primarily from data obtained on a fully loaded MER carrying M117 stores. Since the data base for the method is restricted to essentially one store type, a scaling factor has been defined in an attempt to scale the airloads predicted herein to other store types based on differences in isolated aerodynamic characteristics and physical size. The scaling factors for side force and normal force are presented below.

$$K_{SCALE_{SF}} = \frac{\left(\frac{SF}{q}\right)_{\psi_{ISO}} SPA}{96}$$

where

$\left(\frac{SF}{q}\right)_{\psi_{ISO}}$ - Store isolated characteristics, $C_{L_{\alpha_{ISO}}} S_{REF}$, where $C_{L_{\alpha_{ISO}}}$ is obtained from the method referenced in Subsection 2.2, $\frac{ft^2}{deg}$

SPA - Store total side projected area as defined in Subsection 2.2, $in^2$

$$K_{SCALE_{NF}} = \frac{\left(\frac{NF}{q}\right)_{\alpha_{ISO}} PPA}{90}$$

where

$\left(\frac{NF}{q}\right)_{\alpha_{ISO}}$ - Store isolated characteristics, $C_{L_{\alpha_{ISO}}} S_{REF}$, where $C_{L_{\alpha_{ISO}}}$ is obtained from the method referenced in Subsection 2.2, $\frac{ft^2}{deg}$

PPA - Store plan projected area as defined in Subsection 2.[illegible], $in^2$.

The scaling factors for yawing moment and pitching moment are presented below.

$$K_{SCALE_{YM}} = \frac{\left(\frac{SF}{q}\right)_{\psi_{ISO}} PPA}{71.4}$$

where

$\left(\frac{SF}{q}\right)_{\psi_{ISO}}$ - Defined above

PPA - Defined above.

$$K_{SCALE_{PM}} = \frac{\left(\frac{NF}{q}\right)_{\alpha_{ISO}} PPA}{71.4}$$

where

$\left(\frac{NF}{q}\right)_{\alpha_{ISO}}$ - Defined above

PPA - Defined above.

These factors are used in the equations throughout Section IV where required.

The airloads predicted for MER/store configurations assume that the MER is fully loaded.

## 4.1 SIDE FORCE

### 4.1.1 Basic Airload

The basic captive store airload is that airload generated by a zero-yaw pitch excursion of the parent aircraft.

#### 4.1.1.1 Slope Prediction

The prediction of the variation of captive store side force with angle of attack is divided into two sections, fuselage centerline-mounted configurations and wing pylon-mounted configurations. The technique presented in this section predicts the slope, $\left(\frac{SF}{q}\right)_{\alpha}$, at M = 0.5.

FUSELAGE CENTERLINE-MOUNTED STORES

MER STATIONS 1 and 2 (MS1,2):

$$\left(\frac{SF}{q}\right)_{\alpha_{PRED_{\mathfrak{C}}}}_{MS1,2} = 0, \text{ due to symmetry}$$

MER STATIONS 3,4,5,6 (MS3-6):

$$\left(\frac{SF}{q}\right)_{\alpha_{PRED_{\mathfrak{C}}}}_{MS3-6} = C_{y_{\alpha_{\mathfrak{C}}}}{}_{MS3-6} \quad S_{REF} = f(d)$$

where

$C_{y_{\alpha_{\mathfrak{C}}}}$ - Variation of $C_{y_{\alpha}}$ presented as a function of store diameter, Figure 330.

$S_{REF}$ - Store reference area, $\frac{\pi d^2}{4}$, $ft^2$.

WING MOUNTED STORES

MER STATION 1:

$$\left(\frac{SF}{q}\right)_{\alpha_{\substack{PRED\\MS1}}} = K_{C_{\substack{SF\\MS1}}} \left(\frac{SF}{q}\right)_{\psi_{ISO}} K_{\eta_{MS1}} K_{\frac{\ell_{LE_A}}{c}} K_{\frac{Z}{c}} K_{\Lambda_1}$$

where:

$K_{C_{\substack{SF\\MS1}}} \left(\frac{SF}{q}\right)_{\psi_{ISO}}$ – Initial side force slope prediction, $\frac{ft^2}{deg.}$, see Subsection 2.3.2.

$K_{\eta_{MS1}}$ – Store spanwise position correction factor, Figure 331.

$K_{\frac{\ell_{LE_A}}{c}}$ – Correction factor based on the distance from the wing leading edge to the nose of the store on MER STA 1 measured in a wing plan view divided by the local wing chord, positive, Figure 332.

$K_{\frac{Z}{c}}$ – Correction factor based on pylon height divided by the local wing chord, Figure 333.

$K_{\Lambda_1}$ – Wing sweep correction factor, $\frac{\sin \Lambda}{\sin 45^\circ}$, where $\Lambda$ is the quarter-chord sweep angle of aircraft wing.

MER STATION 2:

$$\left(\frac{SF}{q}\right)_{\alpha_{\substack{PRED\\MS2}}} = K_{C_{\substack{SF\\MS2}}} \left(\frac{SF}{q}\right)_{\psi_{ISO}} K_{\eta_{MS2}} K_{\Lambda_1}$$

where

$K_{C_{SF}} \left(\frac{SF}{q}\right)_{\psi_{ISO}}$ MS2 - Initial side force slope prediction, $\frac{ft^2.}{deg.}$, see Subsection 2.3.2

$K_{\eta}$ MS2 - Store spanwise position correction factor, Figure 331.

$K_{\Lambda_1}$ - Defined above.

MER STATIONS 3, 4, 5, 6 (MS3,5; MS4,6):

$$\left(\frac{SF}{q}\right)_{\alpha_{PRED}\ \substack{MS3,5 \\ MS4,6}} = [K_{C_{SF}} \left(\frac{SF}{q}\right)_{\psi_{ISO}\ \substack{MS1 \\ MS2}} + \Delta C_{y_{\alpha}\ \substack{MS3,5 \\ MS4,6}} K_{SCALE_{SF}}] K_{\Lambda_1}$$

where

$K_{C_{SF}} \left(\frac{SF}{q}\right)_{\psi_{ISO}}$ - Initial side force slope prediction, $\frac{ft^2.}{deg.}$, see Subsection 2.3.2. MS1 initial prediction is used for MS3,5 while MS2 is combined with MS4,6.

$\Delta C_{y_{\alpha}}$ - Incremental side force coefficient slope presented as a function of local chord, $\frac{1}{deg}$.

MER STA 3 - Figure 334

MER STA 4 - Figure 334

MER STA 5 - Figure 335

MER STA 6 - Figure 335

Example: Compute the side force variation with angle of attack, $\left(\frac{SF}{q}\right)_\alpha$, for an M117 store on MER STATION 6 of a fully loaded MER on the A-7 center pylon at M = 0.5.

Required for Computation:

$$K_{C_{SF_{MS2}}}\left(\frac{SF}{q}\right)_{\psi_{ISO}} = .111\ \frac{ft^2}{deg}, \text{ see example Subsection 2.3.2}$$

$$C_{LOCAL} = 127.6 \text{ in.}$$

$SPA = 1200\ in^2$. Subsection 2.2.2

$$\left(\frac{SF}{q}\right)_{\psi_{ISO}} = .114\ \frac{ft^2}{deg}, \text{ Subsection 2.3.2}$$

$$K_{\Lambda_1} = \frac{\sin 35°}{\sin 45°} = .811$$

$$K_{SCALE_{SF}} = \frac{\left(\frac{SF}{q}\right)_{\alpha_{ISO}} SPA}{96}$$

$$\Delta C_{y_{\alpha_{MS6}}} = -.01 - \text{Figure 335}$$

then

$$\left(\frac{SF}{q}\right)_{\alpha_{PRED_{MS6}}} = [.111 + (-.01)\frac{(.114)(1200)}{96}].811$$

$$= .078\ \frac{ft^2}{deg}$$

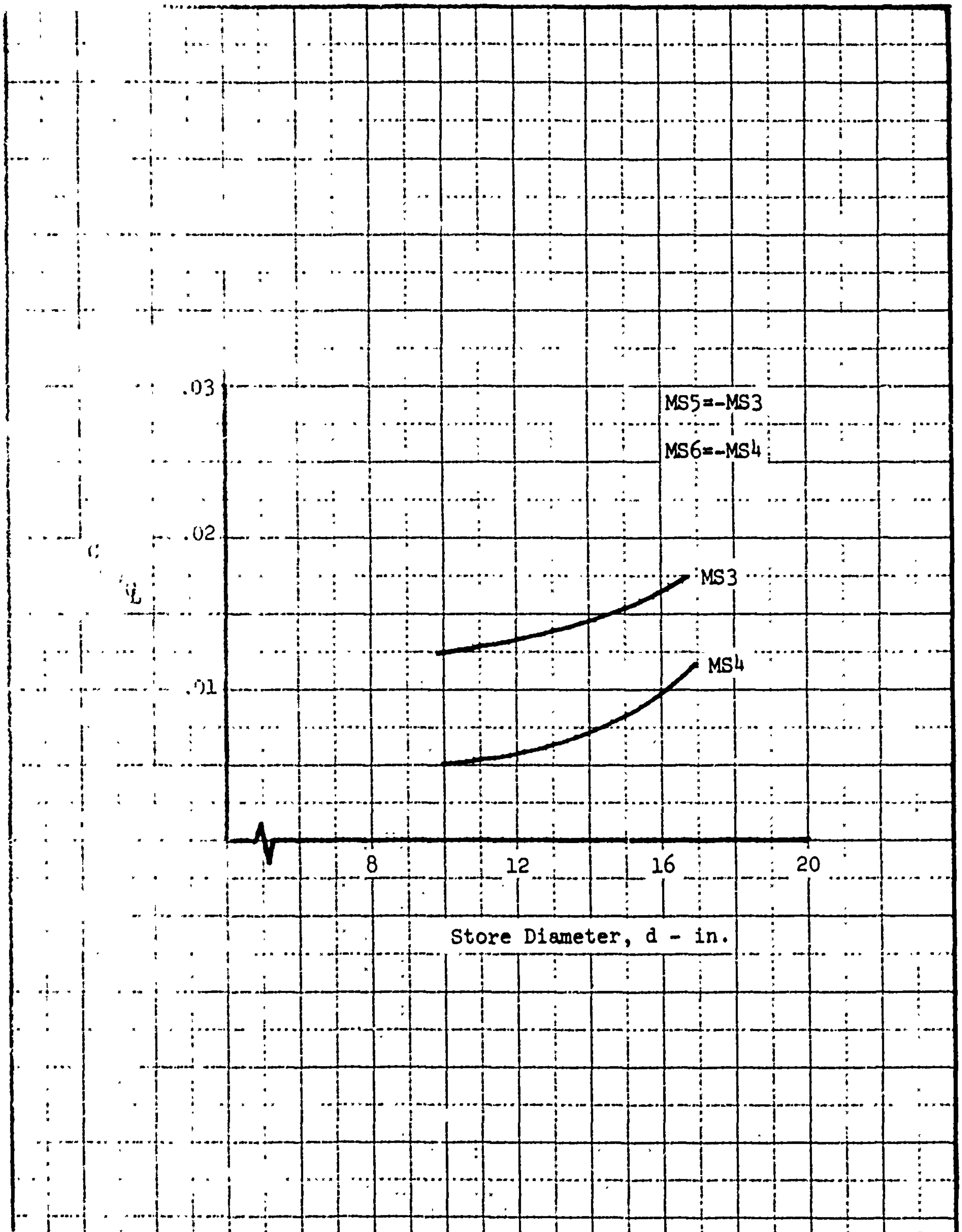



Figure 330. Side Force Slope-Stores Mounted on Fuselage Centerline, MER Stations 3-6

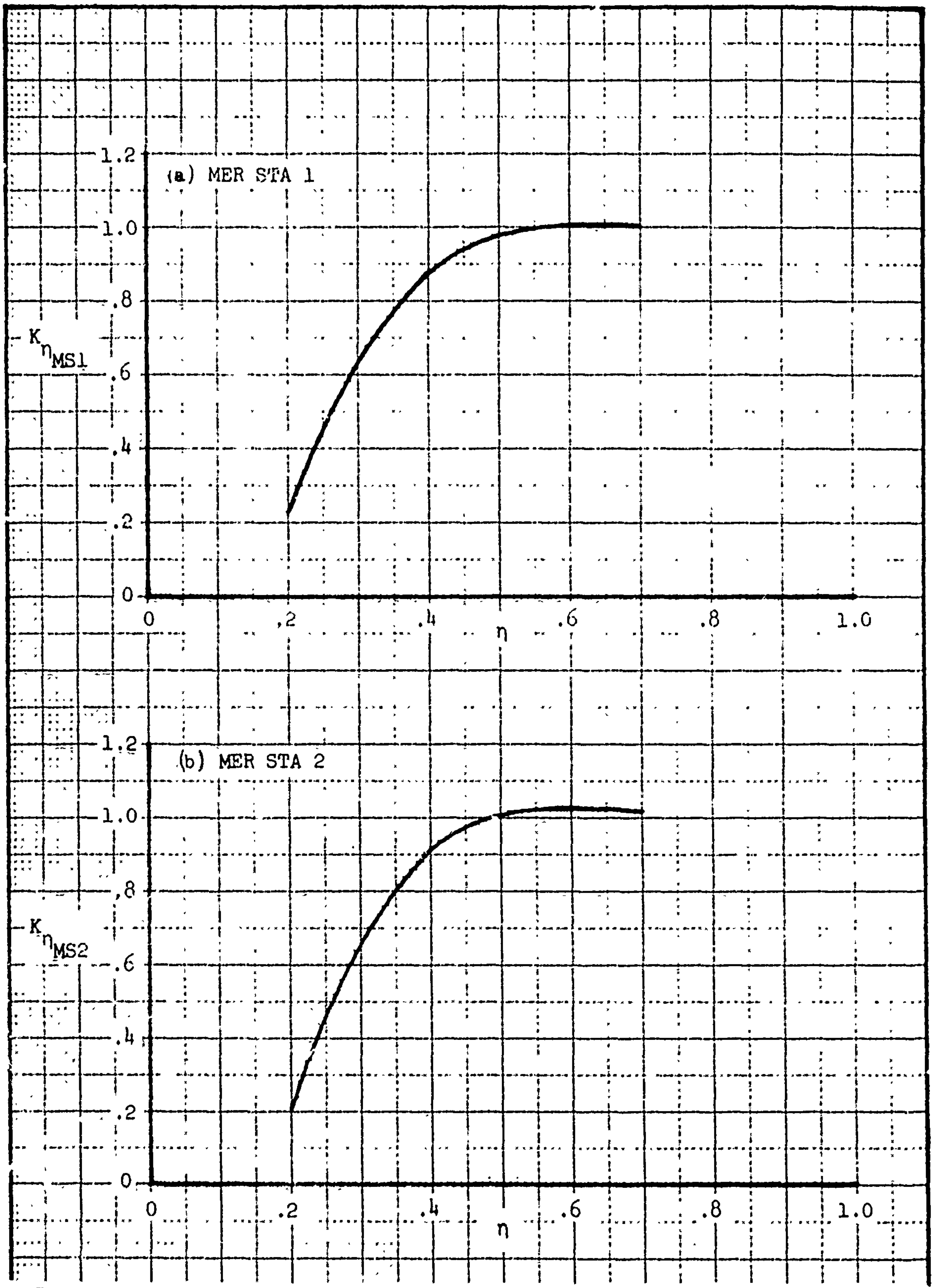



Figure 331. Side Force Slope - Spanwise Correction for MER Stations 1 and 2

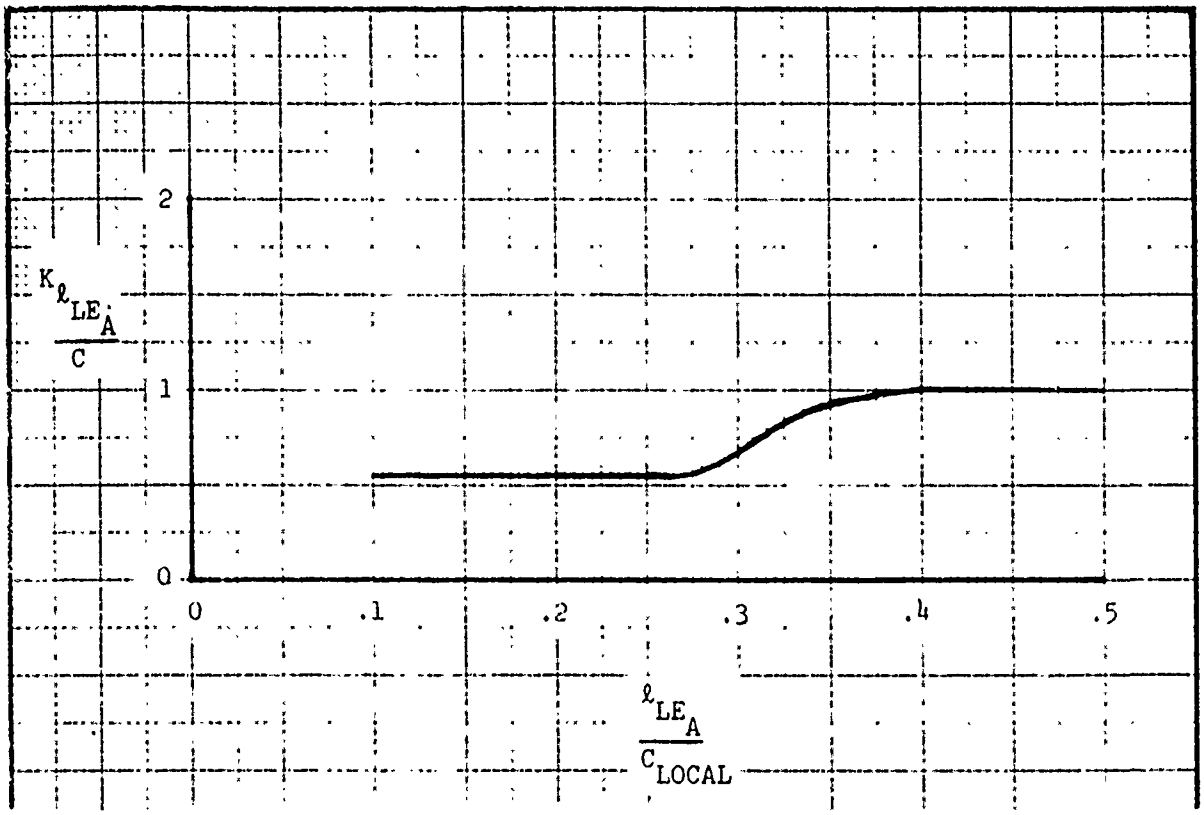



Figure 332. Side Force Slope - Chordwise Position Correction for MER Station 1

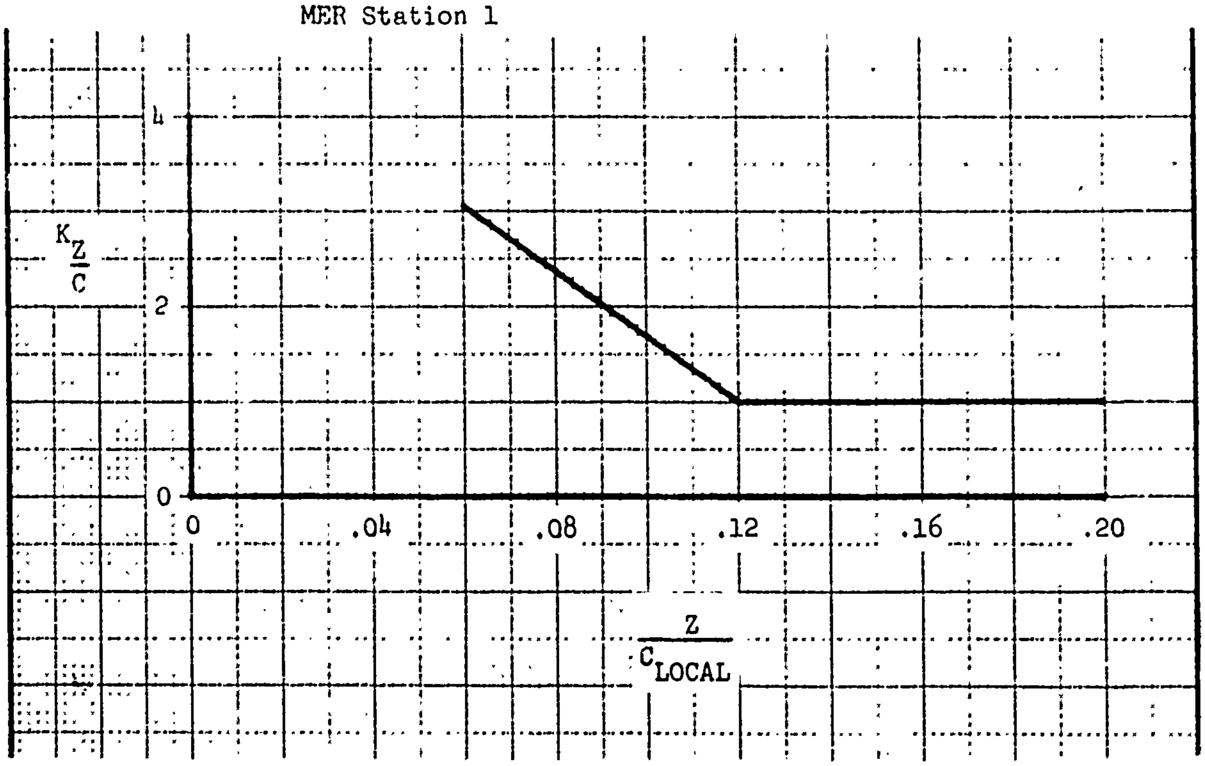



Figure 333. Side Force Slope - Pylon Height Correction for MER Station 1

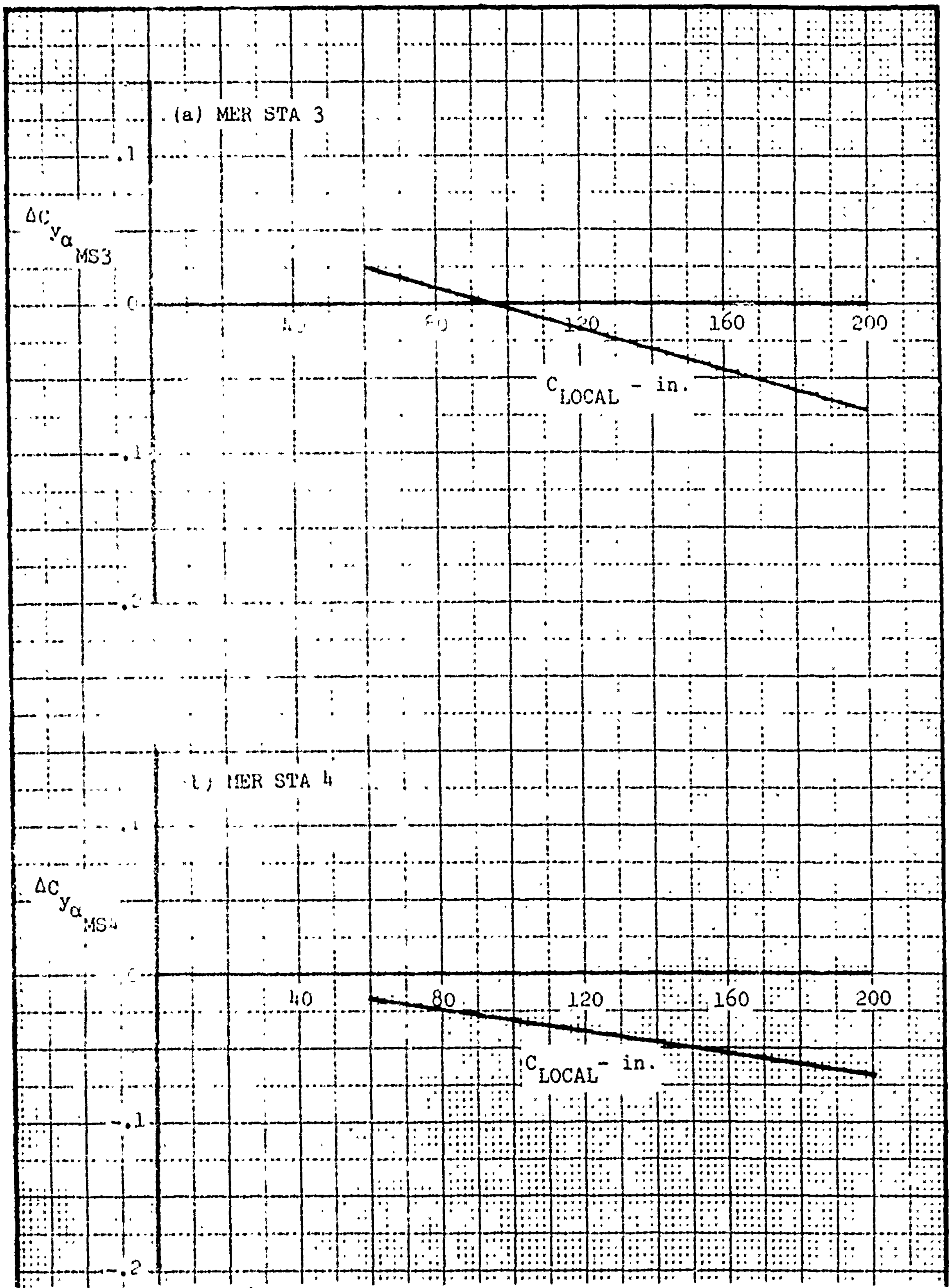



Figure 334. Side Force Slope - Incremental Coefficient for MER Stations 3 and 4

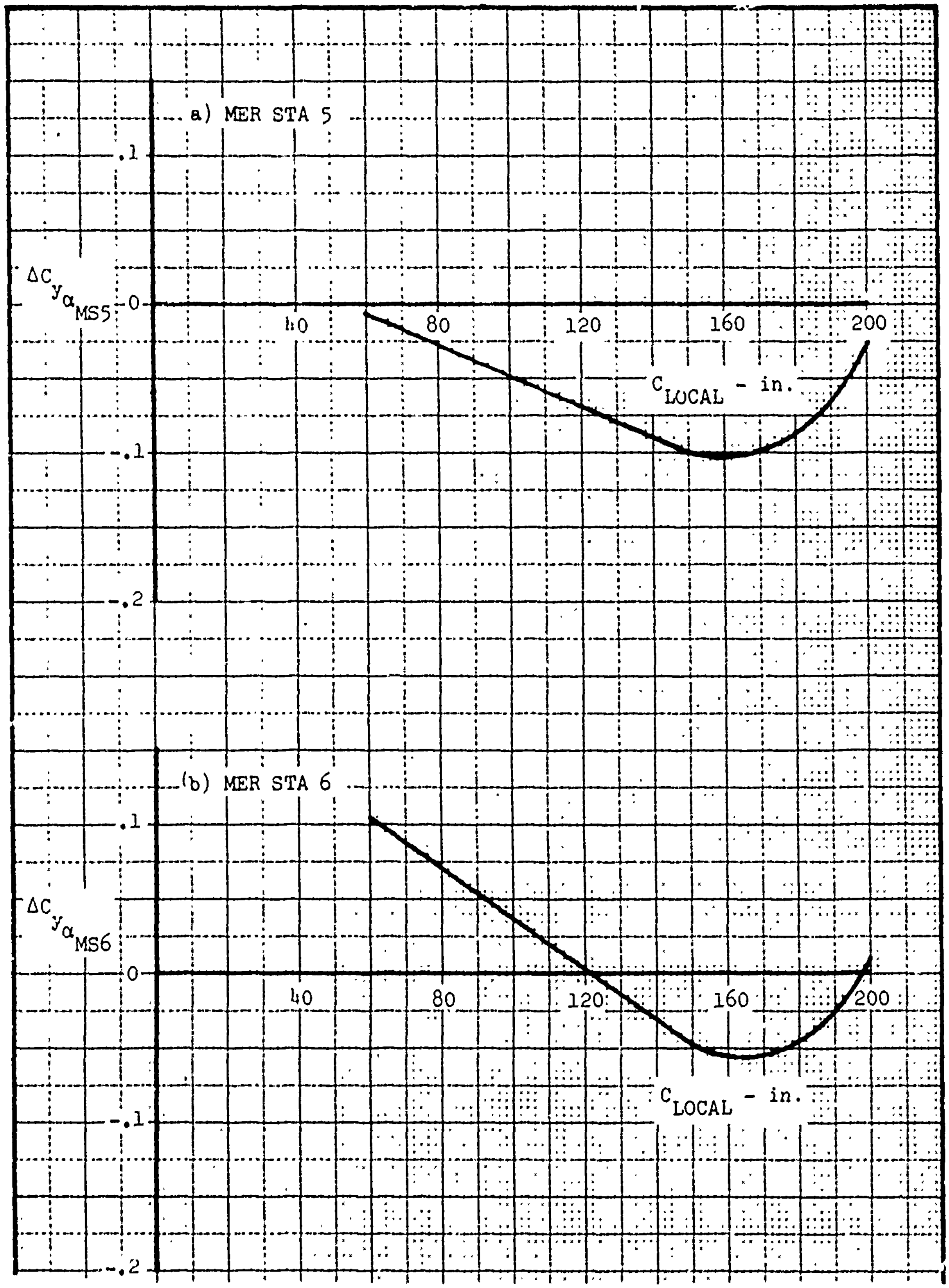



Figure 335. Side Force Slope - Incremental Coefficient for MER Stations 5 and 6

4.1.1.2 Slope Mach Number Correction

To compute the variation in side force slope, $\left(\frac{SF}{q}\right)_\alpha$, between M = 0.5 and M = 1.6, use the following expression.

$$\left(\frac{SF}{q}\right)_{\alpha_{M=x}} = \left(\frac{SF}{q}\right)_{\alpha_{PRED}} + \Delta\left(\frac{SF}{q}\right)_{\alpha_{M=x}}$$

where:

$\left(\frac{SF}{q}\right)_{\alpha_{PRED}}$ - Side force slope predicted at M = 0.5.

$\Delta\left(\frac{SF}{q}\right)_{\alpha_{M=x}}$ - Increment in side force slope at M = x.

FUSELAGE CENTERLINE MOUNTED STORES

MER STATIONS 1 AND 2 (MS1,2):

$$\left(\frac{SF}{q}\right)_{\alpha_{\substack{M=x\\MS1,2}}} = 0\text{, due to symmetry}$$

MER STATIONS 3, 4, 5, 6 (MS3-6):

$$\left(\frac{SF}{q}\right)_{\alpha_{\substack{MS3-6\\M=x}}} = \left(\frac{SF}{q}\right)_{\alpha_{\substack{PRED_{\mathbb{C}}\\MS3-6}}} + \Delta C_{y_{\alpha_{\substack{\mathbb{C}\\MS3-6}}}} K_{SCALE_{SF}}$$

where:

$\left(\frac{SF}{q}\right)_{\alpha_{PRED_{\mathbb{C}}}}$ - Slope predicted for fuselage centerline stores at M = 0.5, Subsection 4.1.1.1.

$\Delta C_{y_{\alpha_{\mathbb{C}}}}$ - Incremental side force coefficient slope presented as a function of Mach number, Figure 337.

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

WING MOUNTED STORES

A generalized curve depicting the side force slope variation with Mach number is given by Figure 336.

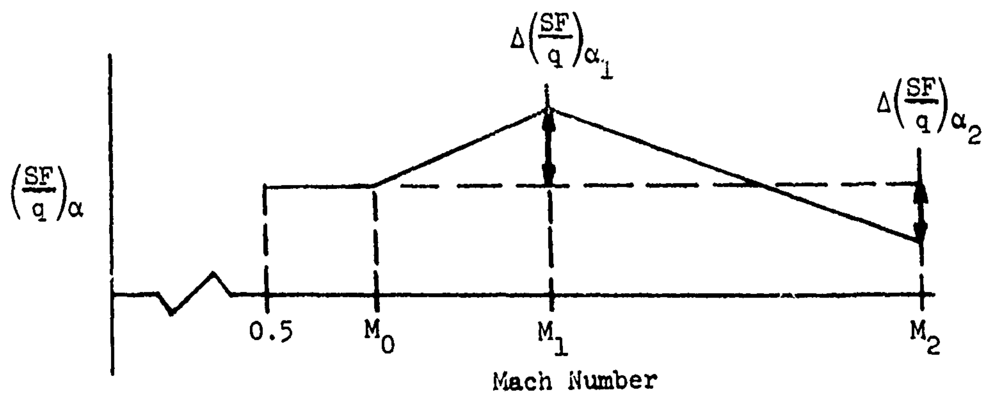



Figure 336. Side Force Slope - Generalized Mach Number Variation

The side force slope variation with Mach number has been approximated by a series of linear segments with breakpoints occurring at Mach numbers defined by $M_0$, $M_1$, and $M_2$ for each of the six MER stations. The variations of the Mach break points are presented in Figure 338 (MS1, 2), Figure 339 (MS4, 6), and Figure 340 (MS3,5) as a function of $C_{LOCAL}K_{\Lambda_1}$. $M_0$ is the Mach number where the slope initially deviates from the slope predicted at M = 0.5. Equations have been developed to predict the delta (incremental) slope change from that predicted at M = 0.5 for each of the six MER stations. These equations are presented below

Break 1 ($M_1$):

MER STATION 1 (MS1):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_{1_{MS1}}} = K_{SLOPE_{1_{MS1}}}(M_1 - M_0)K_{SCALE_{SF}}K_{\Lambda_1}$$

where:

$K_{SLOPE_1}$ - Variation of $\Delta C_{y_\alpha}$ with Mach number presented as a function of semi-span position, $\eta$, Figure 341.

$M_1 - M_0$ - Delta Mach number

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft.^2$

$K_{\Lambda_1}$ - Wing sweep correction factor, $\frac{\sin \Lambda}{\sin 45°}$, is the quarter chord sweep angle of the aircraft wing.

MER STATIONS 2, 4 and 6 (MS2,4,6):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_{1_{MS2,4,6}}} = (K_{SLOPE_{1_{MS2,4,6}}} + \Delta K_{SLOPE_{1_{INTF_{MS2,4,6}}}})(M_1 - M_0) \cdot (K_{SCALE_{SF}}K_{\Lambda_1})$$

where: $K_{SLOPE_1}$ - Variation of $C_{y_\alpha}$ with Mach number presented as a function of $C_{LOCAL}K_{\Lambda_1}$, $\frac{1}{deg}$ .

MER STA 2 - Figure 341

MER STA 4 - Figure 343

MER STA 6 - Figure 343

$\Delta K_{SLOPE_{1_{INTF}}}$ - Increment in $K_{SLOPE_1}$ due to the interference effect of the fuselage for high wing aircraft, $\frac{1}{deg}$, Figure 342.

$M_1 - M_o$ - Defined under Break 1, MS1.

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Defined under Break 1, MS1

MER STATIONS 3 and 5 (MS3,5):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_1 \, MS3,5} = \Delta C_{y_{\alpha_1} \, MS3,5} \, K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha_1}}$ - Incremental $C_{y_\alpha}$ presented as a function of $C_{LOCAL} K_{\Lambda_1}$, $\frac{1}{deg}$.

MER STA 3 - Figure 344

MER STA 5 - Figure 344

Break 2 ($M_2$):

MER STATIONS 1,2,4,6 (MS1,2,4,6):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_2 \, MS1,2,4,6} = \Delta\left(\frac{SF}{q}\right)_{\alpha_1 \, MS1,2,4,6} + K_{SLOPE_2 \, MS1,2,4,6} \cdot (M_2 - M_1) K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta\left(\frac{SF}{q}\right)_{\alpha_1}$ - Increment computed under Break 1 for the appropriate MER station.

$K_{SLOPE_2}$ - Variation of $\Delta C_{y_\alpha}$ with Mach number presented as a function of $C_{LOCAL} K_{\Lambda_1}$, $\frac{1}{deg}$.

MER STA 1 - Figure 345

MER STA 2 - Figure 345

MER STA 4 - Figure 346

MER STA 6 - Figure 346

$M_2 - M_1$ - Delta Mach number.

$K_{SCALE_{SF}}$ - Defined in Section IV, ft$^2$.

$K_{\Lambda_1}$ - Defined under Break 1, MS1.

MER STATIONS 3 and 5 (MS3,5):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_2 \, MS3,5} = \Delta\left(\frac{SF}{q}\right)_{\alpha_1 \, MS3,5} + \Delta C_{y_{\alpha_2} \, MS3,5} K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta\left(\frac{SF}{q}\right)_{\alpha_1}$ - Incremental side force slope computed under Break 1 for the appropriate MER station.

$\Delta C_{y_{\alpha_2}}$ - Incremental $C_{y_\alpha}$ presented as a function of $C_{LOCAL} K_{\Lambda_1}$, $\frac{1}{deg}$.

MER STA 3 - Figure 347

MER STA 5 - Figure 347

$K_{SCALE_{SF}}$ - Defined in Section IV, ft$^2$.

$K_{\Lambda_1}$ - Defined under Break 1, MS1.

To compute $\left(\frac{SF}{q}\right)_\alpha$ at M = x, first determine from Figures 338, 339, or 340 (for the MER station of interest) between which Mach number break points M = x occurs. Let $M_{LOW}$ be the lower Mach break and $M_{HI}$ be the higher Mach break. Compute $\left(\frac{SF}{q}\right)_\alpha$ at M = x from the expression below.

MER STATIONS 1 - 6 (MS1-6):

$$\left(\frac{SF}{q}\right)_{\alpha_{\substack{M = x \\ MS1-6}}} = \left(\frac{SF}{q}\right)_{\alpha_{\substack{PRED \\ MS1-6}}} + \Delta\left(\frac{SF}{q}\right)_{\alpha_{\substack{M_{LOW} \\ MS1-6}}} + \left(\frac{x - M_{LOW}}{M_{HI} - M_{LOW}}\right)\left[\Delta\left(\frac{SF}{q}\right)_{\alpha_{\substack{M_{HI} \\ MS1-6}}} - \Delta\left(\frac{SF}{q}\right)_{\alpha_{\substack{M_{LOW} \\ MS1-6}}}\right]$$

If $x \le M_0$, $\left(\frac{SF}{q}\right)_{\alpha_{M = x}}$ will be the value obtained in Subsection 4.1.1.1 (the initial term in the above equation).

Example: Compute the side force variation with angle of attack, $\left(\frac{SF}{q}\right)_{\alpha}$, for an M117 store on MER STATION 6 of a fully loaded MER on the A-7 center pylon at M = 0.6.

Required for Computation:

$$C_{LOCAL} = 127.6 \text{ in.}$$

$$K_{\Lambda_1} = \frac{\sin 35°}{\sin 45°} = .811$$

$$K_{SCALE_{SF}} = \frac{\left(\frac{SF}{q}\right)_{\psi_{ISO}} SPA}{96}$$

$$\left(\frac{SF}{q}\right)_{\psi_{ISO}} = .114 \frac{ft^2}{deg}$$

$$SPA = 1200 \text{ in}^2.$$

$$\eta' = .352$$

$$\left(\frac{SF}{q}\right)_{\alpha_{PRED}} = .078 \frac{ft^2}{deg}$$ from example Subsection 4.1.1.1.

From Figure 339, M = 0.6 falls between $M_0$ and $M_1$. Let $M_{LOW} = 0.5$ and $M_{HI} = M_1 = 0.7$.

at $M_{LOW}(M_0)$: $\Delta\left(\frac{SF}{q}\right)_{\alpha_{M_{LOW}\ MS6}} = 0$ (since $M_0$ is the Mach number where the slope first deviates from that predicted at $M = 0.5$).

Break 1 ($M_1$):

$$K_{SLOPE_{1_{MS6}}} = -.185 \text{ - Figure 343}$$

$$\Delta K_{SLOPE_{1_{INTF\ MS6}}} = 0 \text{ - Figure 342}$$

then,

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_{1_{MS6}}} = (-.185 + 0)(0.7 - 0.5)\frac{(.114)(1200)}{96}(.811)$$
$$= -.043 \ \frac{ft^2}{deg}$$

finally,

$$\left(\frac{SF}{q}\right)_{\alpha_{M = 0.6}} = .078 + 0 + \left(\frac{0.6 - 0.5}{0.7 - 0.5}\right)[-.043 - 0]$$
$$= .057 \ \frac{ft^2}{deg}$$

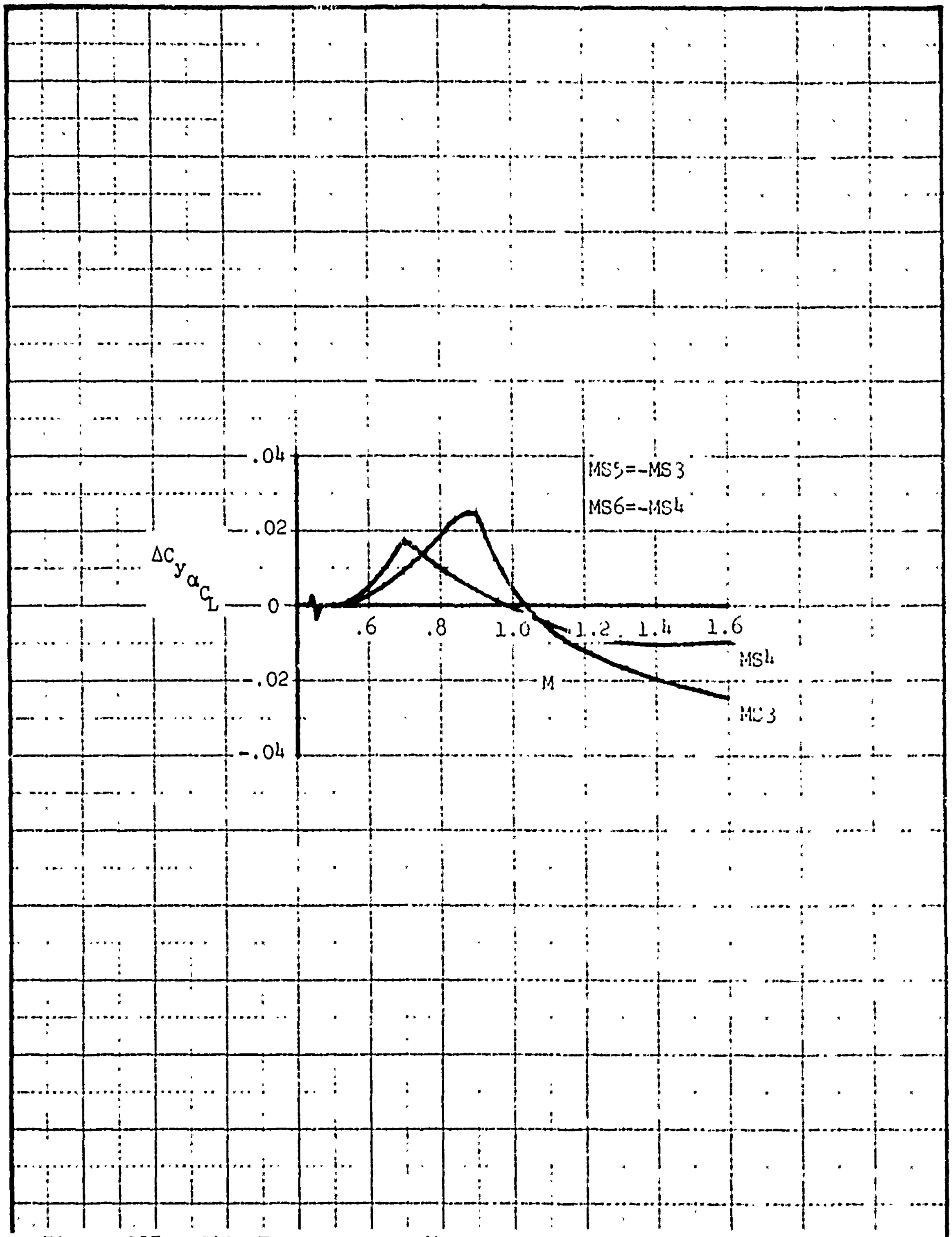



Figure 337. Side Force Slope - Mach Number Correction for Stores Mounted on Fuselage Centerline, MER Stations 3-6

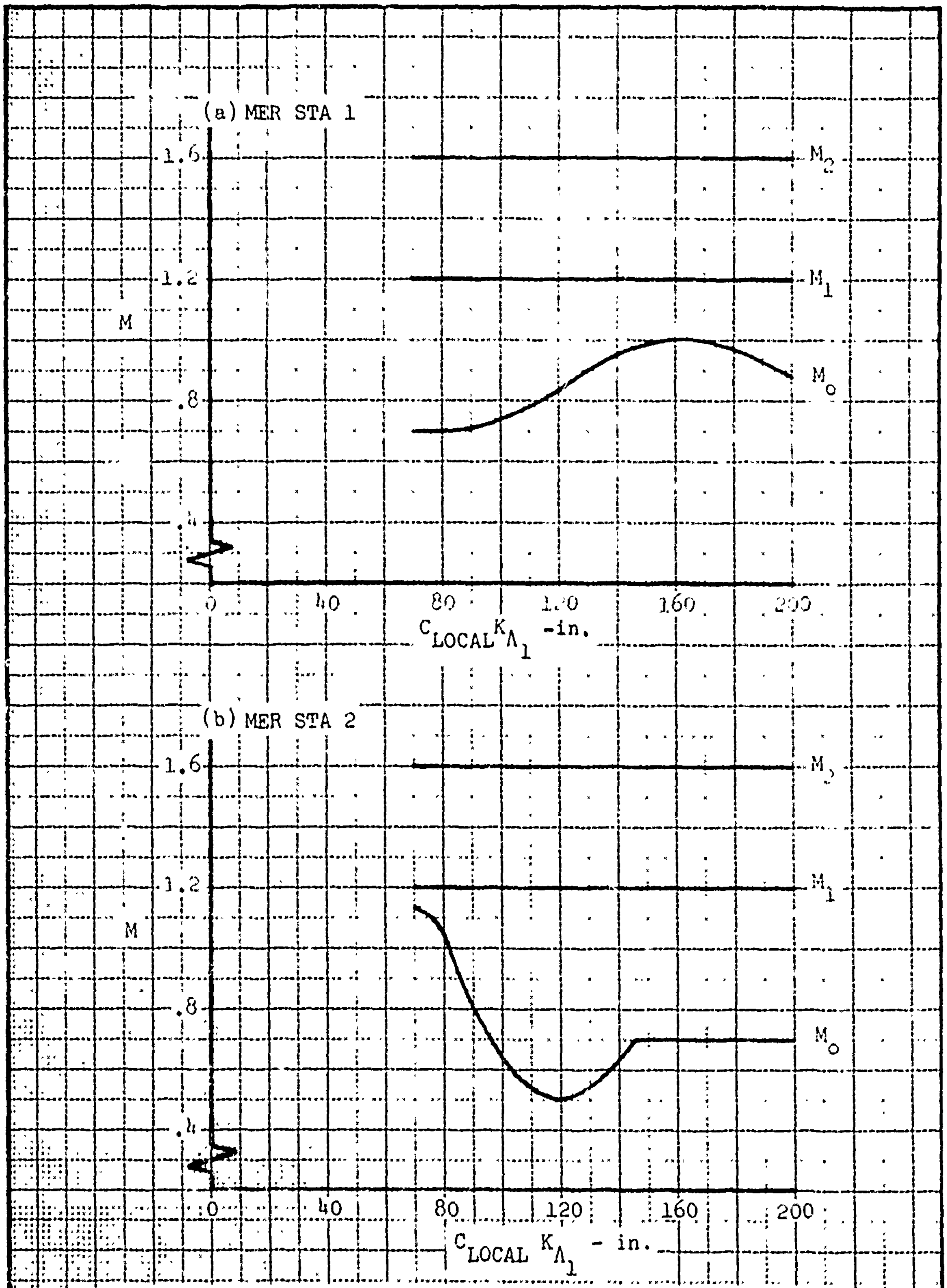



Figure 338. Side Force Slope - Mach Number Break Points for MER Stations 1 and 2

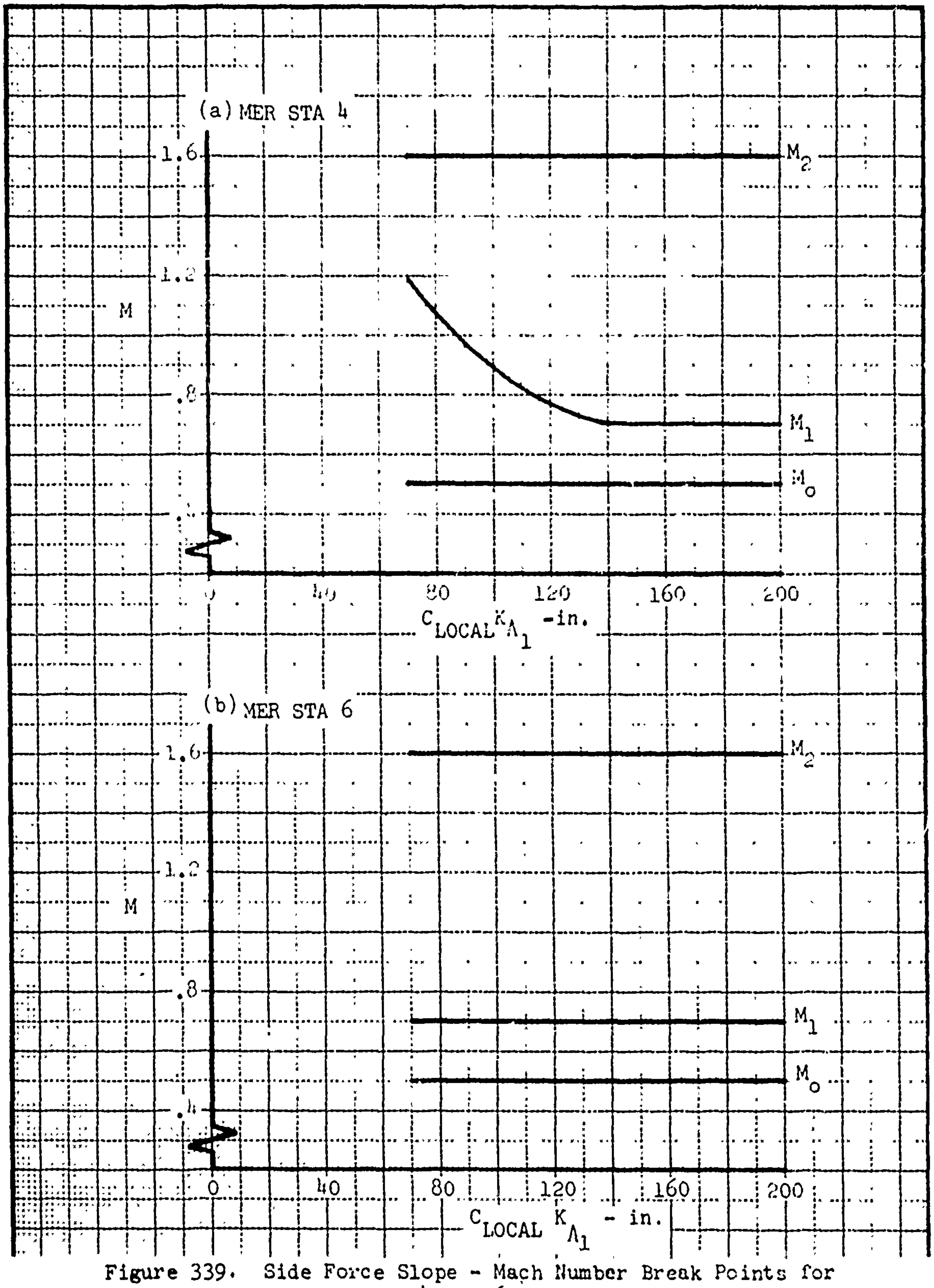



Figure 339. Side Force Slope - Mach Number Break Points for MER Stations 4 and 6

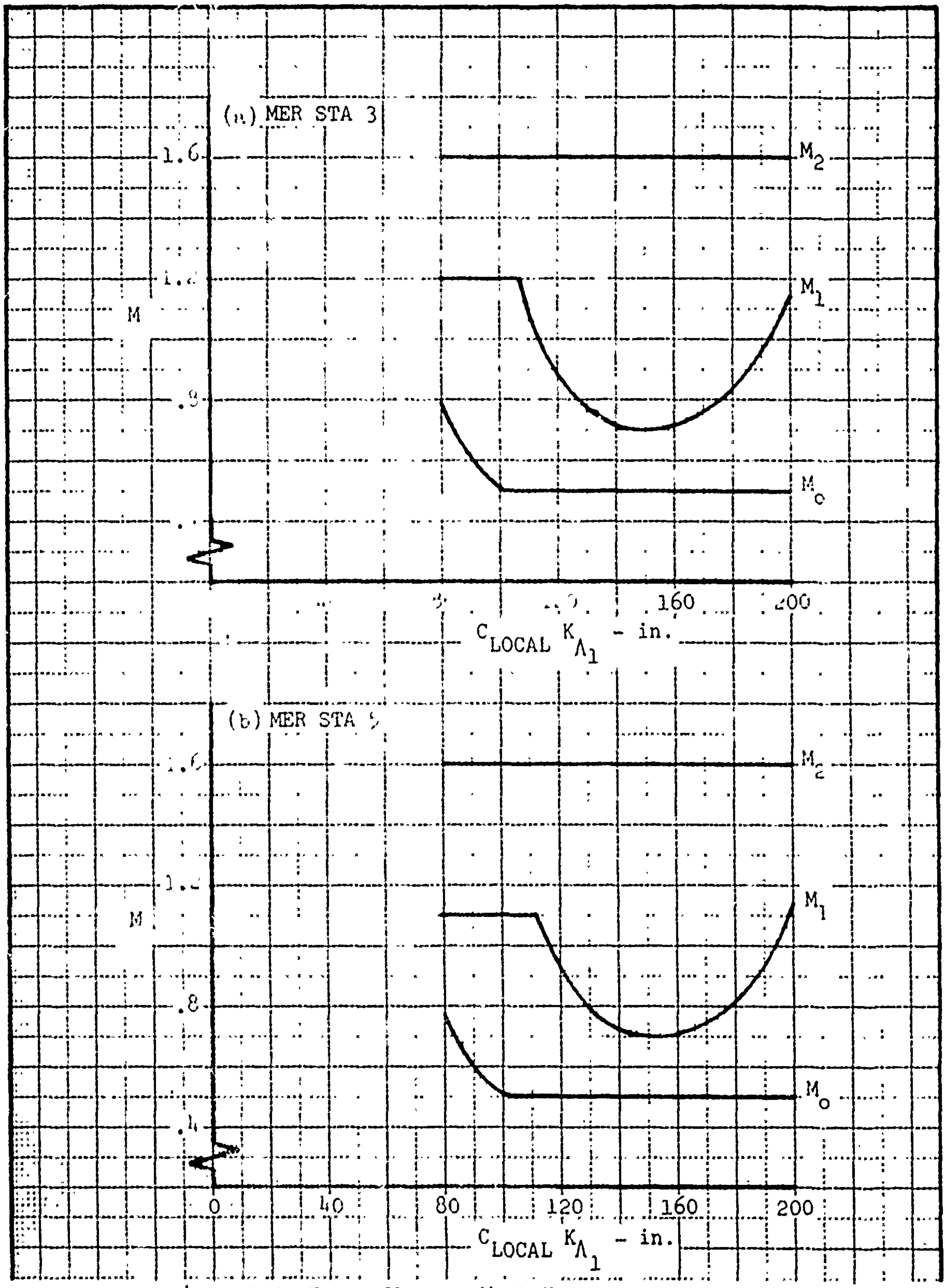



Figure 340. Side Force Slope - Mach Number Break Points for MER Stations 3 and 5

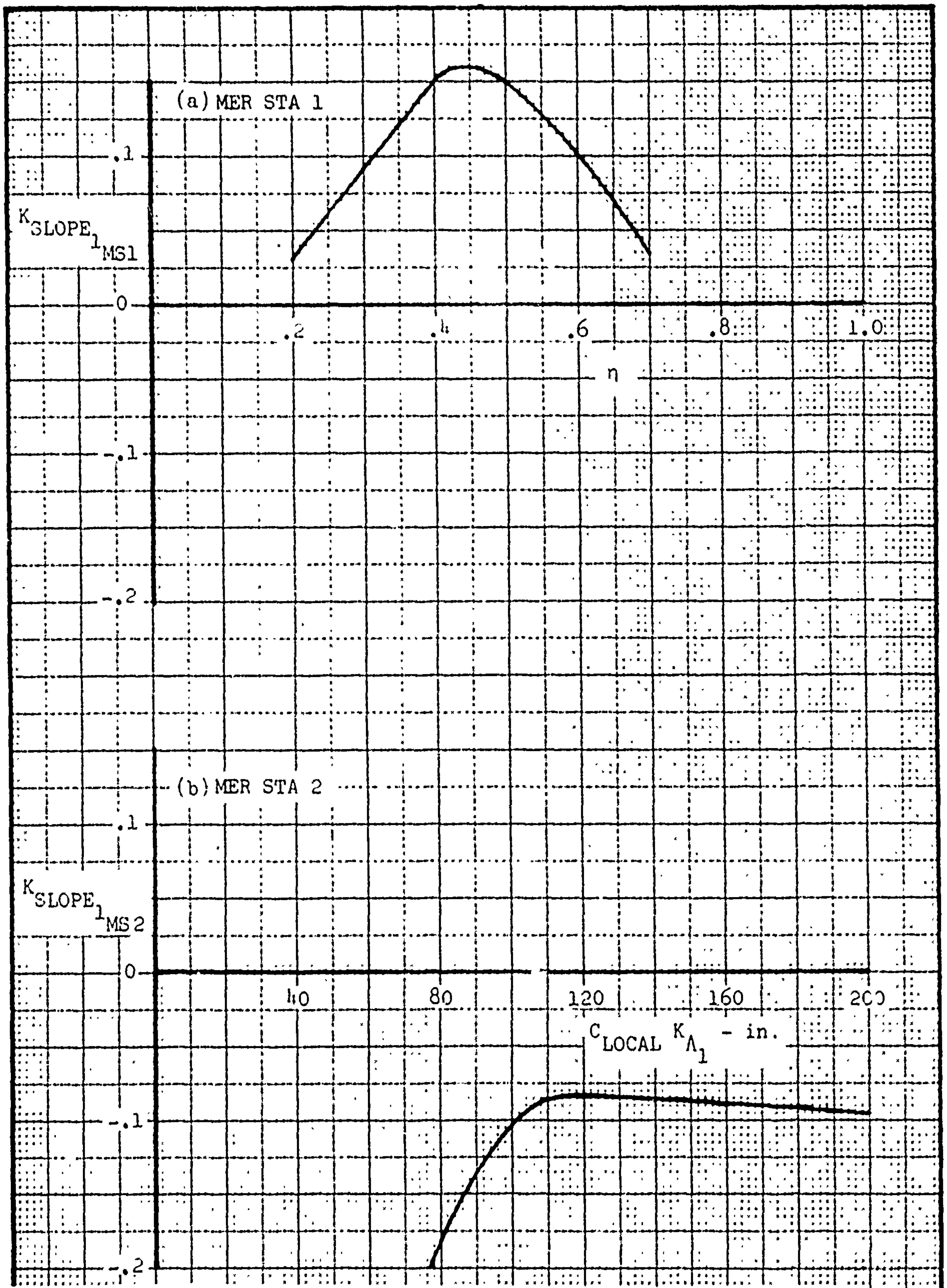



Figure 341. Side Force Slope - $K_{SLOPE_1}$ for MER Stations 1 and 2

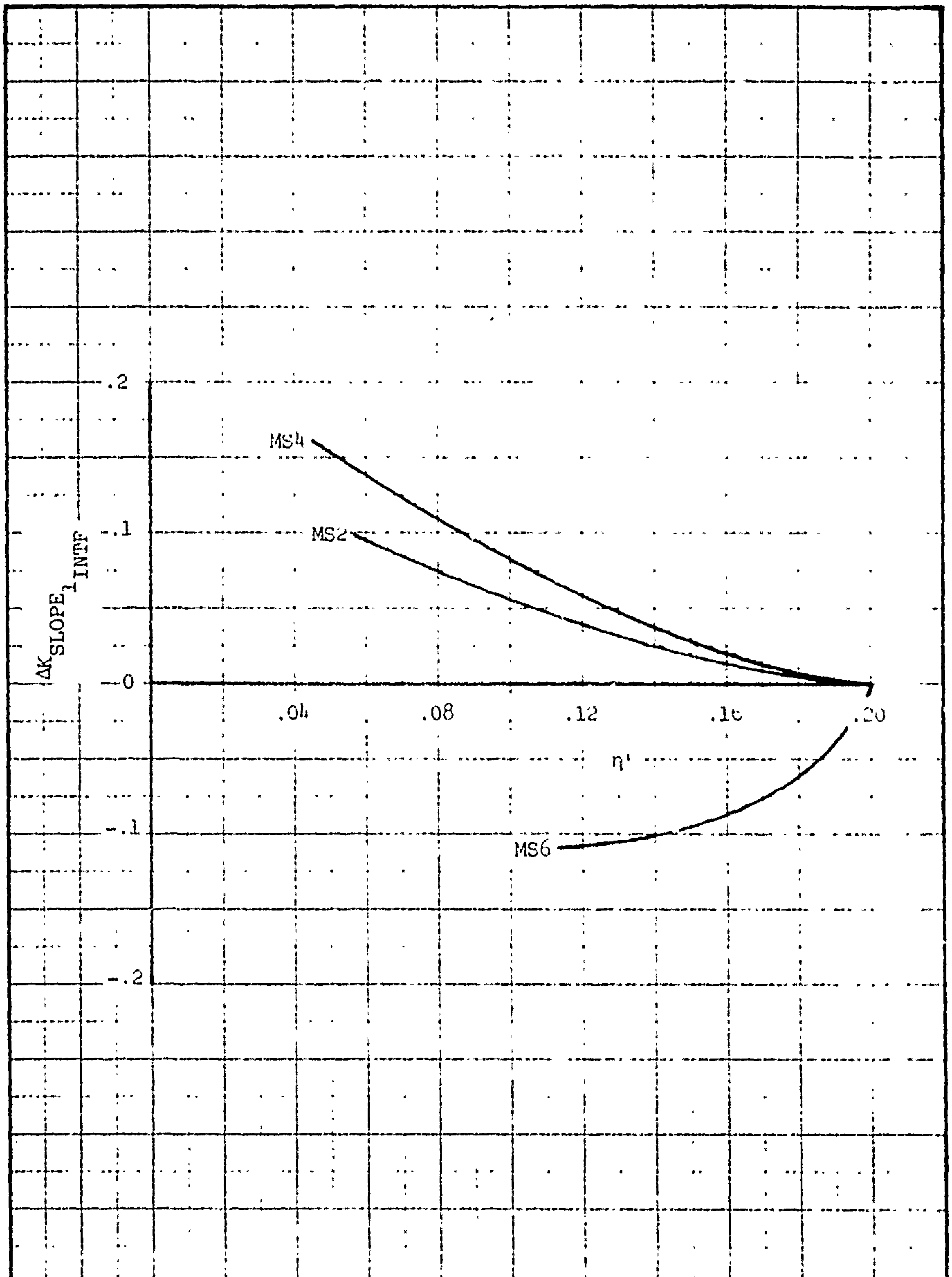



Figure 342. Side Force Slope - $K_{SLOPE_1}$ Fuselage Interference Correction for MER Stations 2, 4 and 6

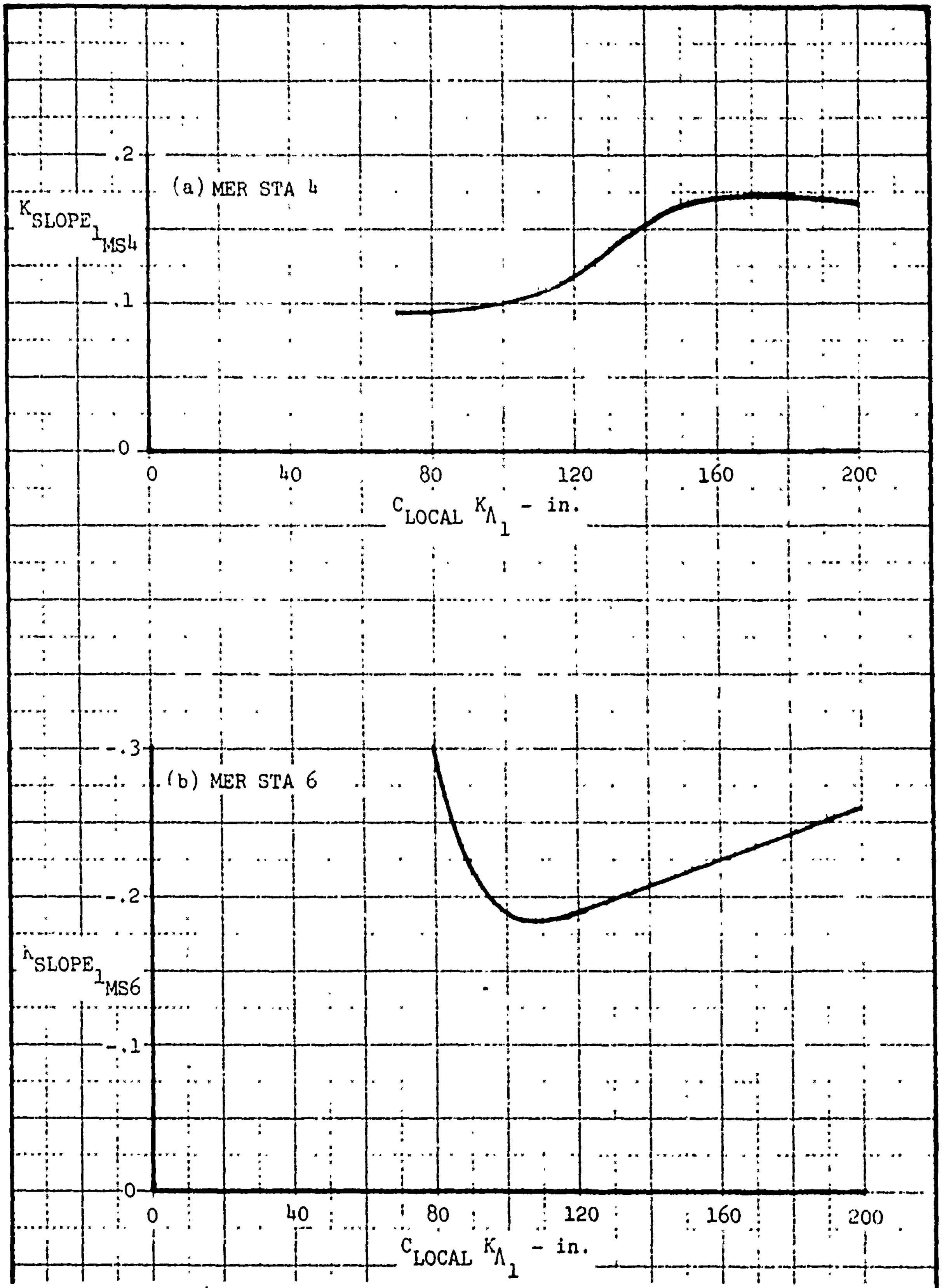
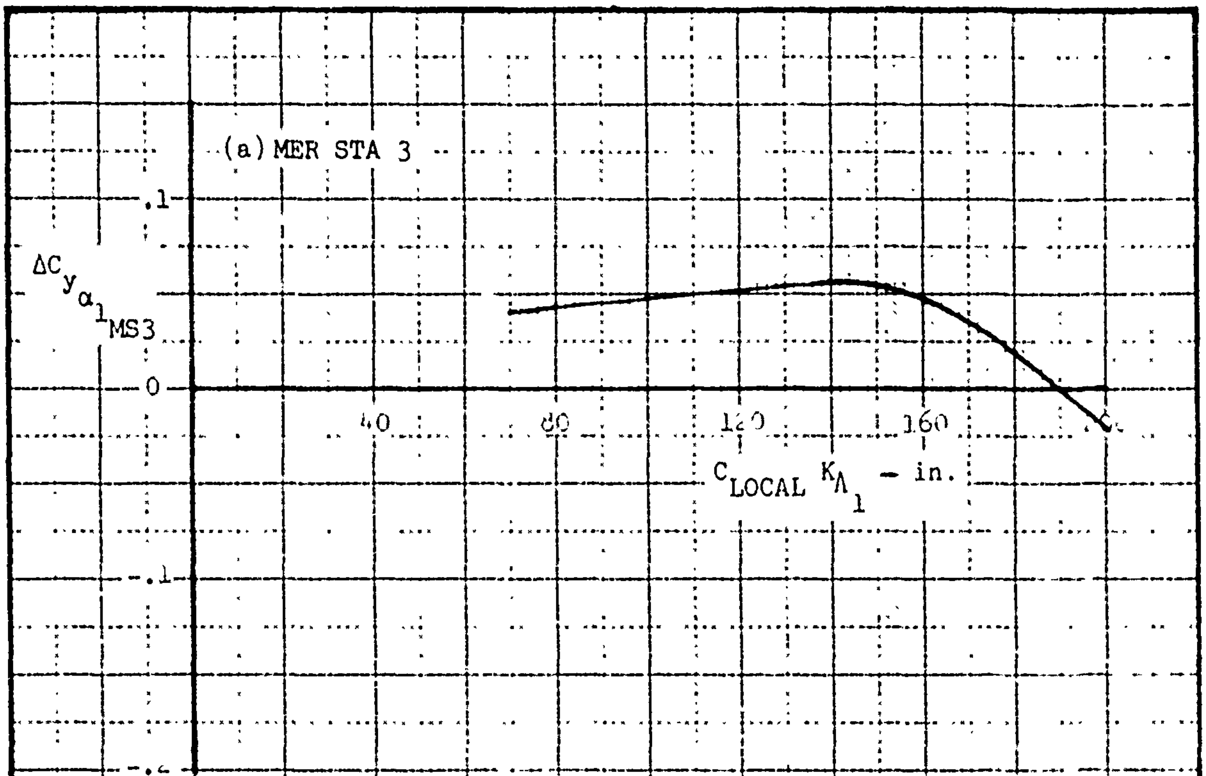



Figure 343. Side Force Slope - $K_{SLOPE_1}$ for MER Stations 4 and 6



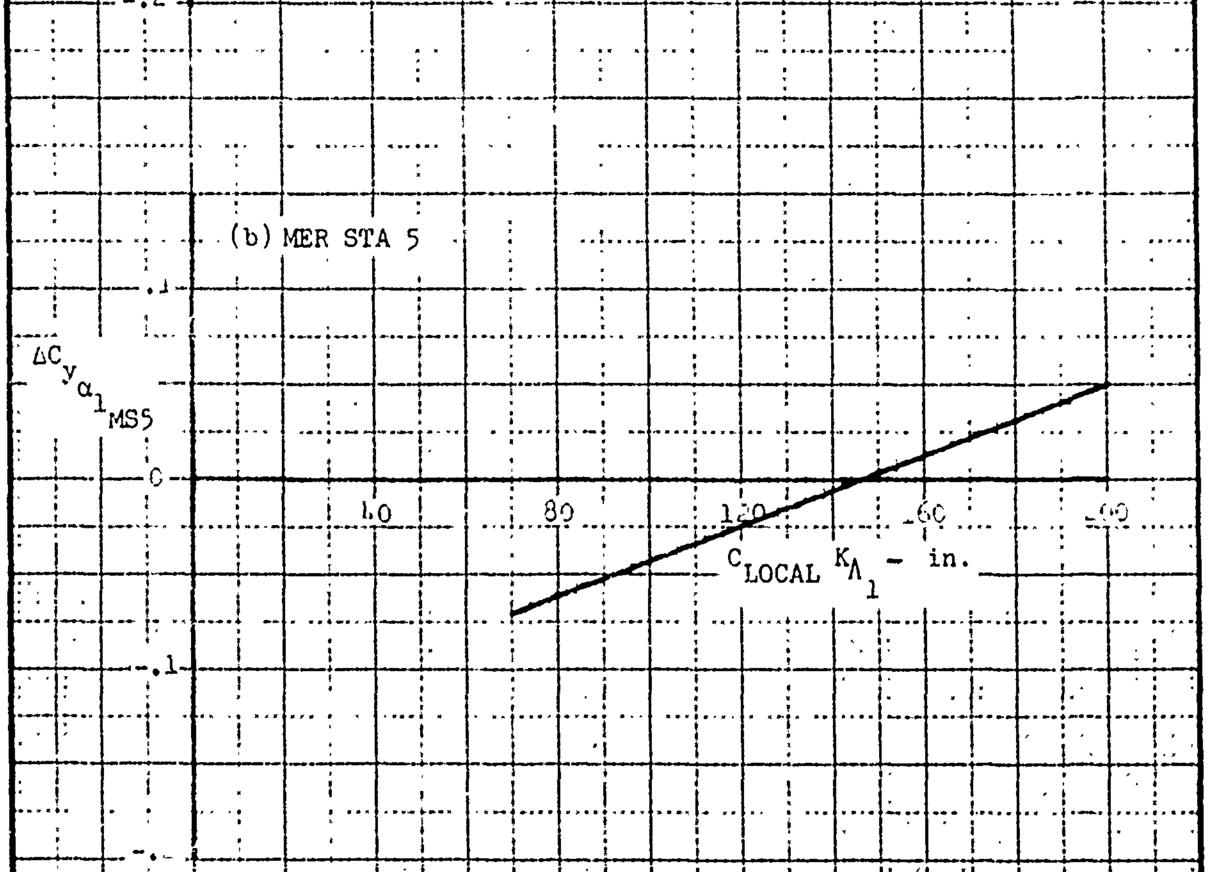




Figure 344. Side Force Slope - Incremental Coefficient at Mach Break 1 for MER Stations 3 and 5

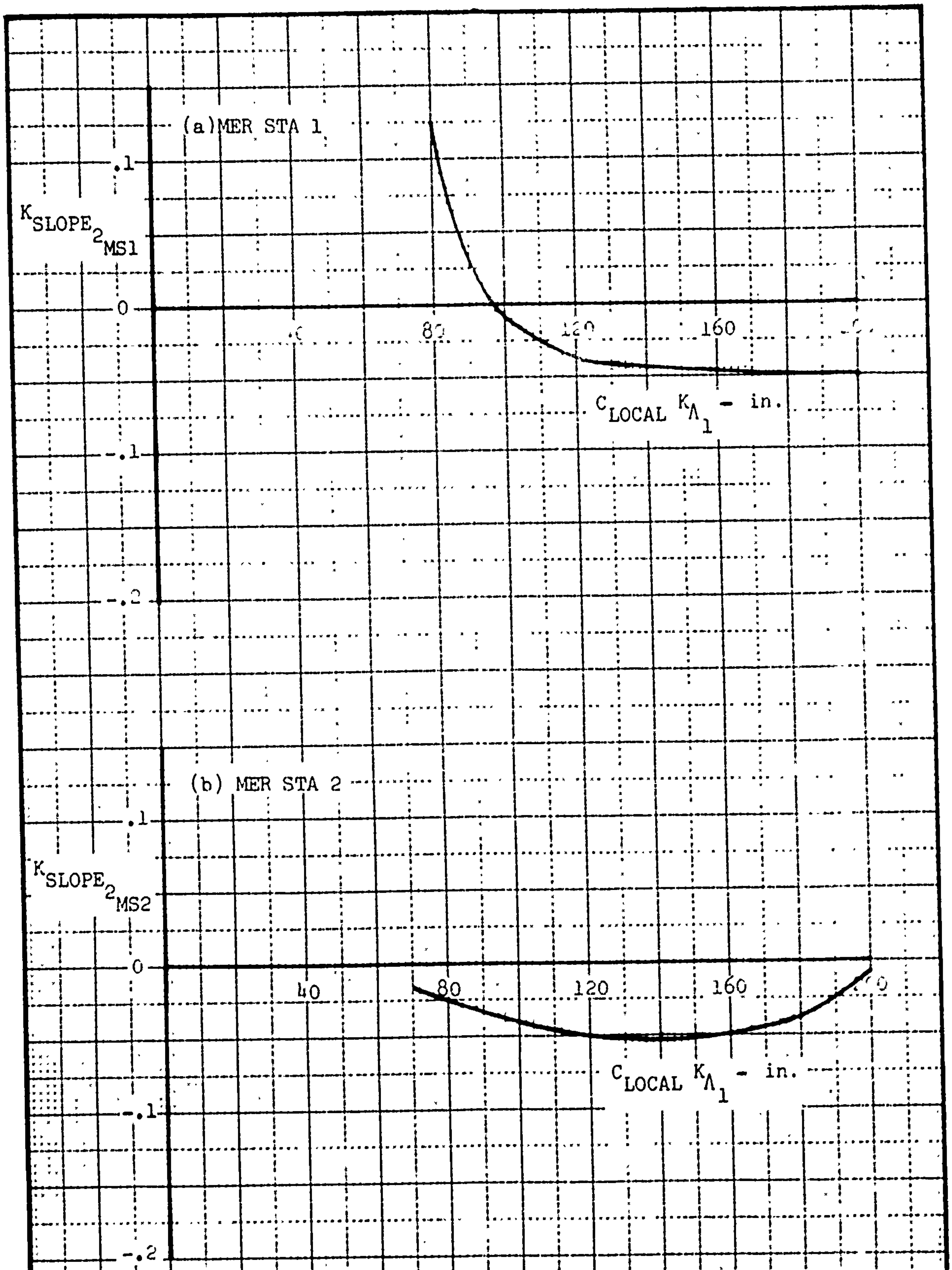



Figure 345. Side Force Slope - $K_{SLOPE_2}$ for MER Stations 1 and 2

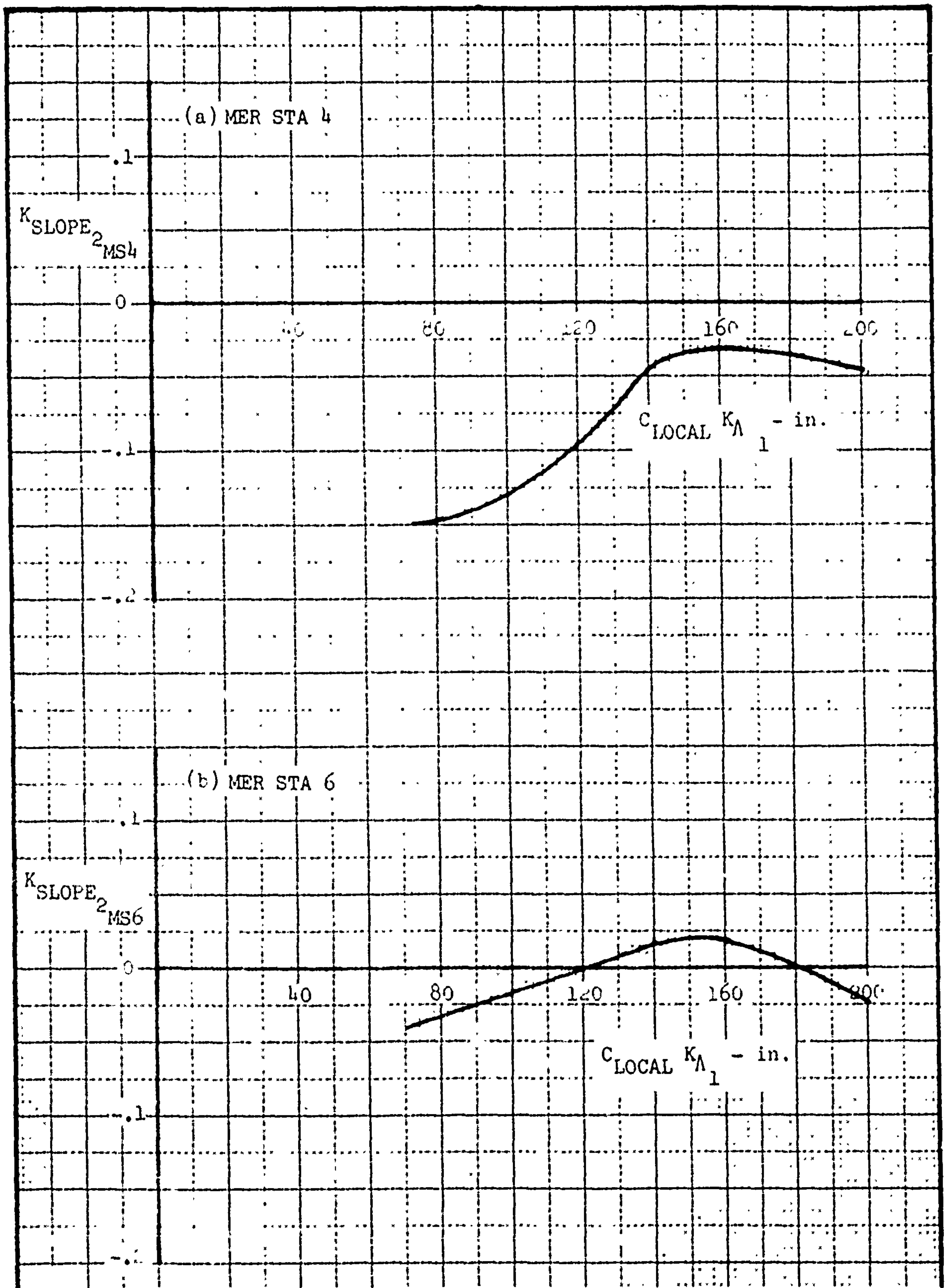



Figure 346. Side Force Slope - $K_{SLOPE_2}$ for MER Stations 4 and 6

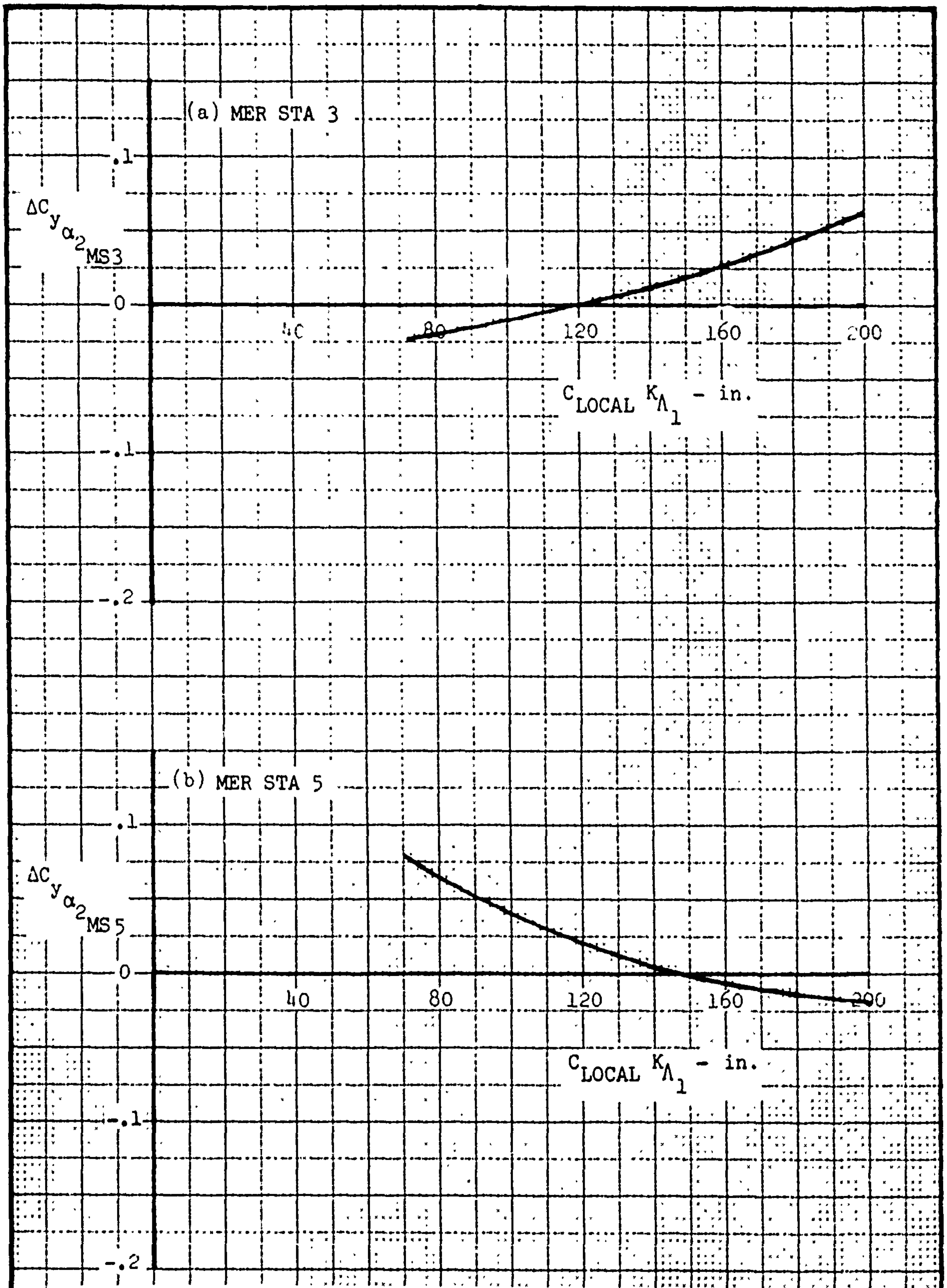



**Figure 347. Side Force Slope - Incremental Coefficient at Mach Break 2 for MER Stations 3 and 5**

4.1.1.3 Intercept Prediction

The prediction of captive store side force intercept, $\left(\frac{SF}{q}\right)_{\alpha=0}$, is divided into two sections, fuselage centerline-mounted stores and wing-mounted stores. The technique presented in this section predicts the side force intercept, $\left(\frac{SF}{q}\right)_{\alpha=0}$, at M = 0.5.

FUSELAGE CENTERLINE-MOUNTED STORES

MER STATIONS 1 and 2 (MS1,2):

$$\left(\frac{SF}{q}\right)_{\alpha=0_{\substack{PRED_{\text{£}} \\ MS1,2}}} = 0, \text{ due to symmetry}$$

MER STATIONS 3,4,5, and 6 (MS3-6):

$$\left(\frac{SF}{q}\right)_{\alpha_{\substack{PRED_{\text{£}} \\ MS3-6}}} = C_{y_{\alpha=0_{\substack{\text{£} \\ MS3-6}}}} S_{REF} = f(d)$$

where:

$C_{y_{\alpha=0_{\text{£}}}}$ - Variation of $C_{y_{\alpha=0}}$ presented as a function of store diameter, Figure 348.

$S_{REF}$ - Store reference, $\frac{\pi d^2}{4}$, ft².

WING-MOUNTED STORES

MER STATIONS 1 and 2 (MS1,2):

$$\left(\frac{SF}{q}\right)_{\alpha=0_{\substack{PRED \\ MS1,2}}} = C_{y_{\alpha=0_{MS1,2}}} K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$C_{y_{\alpha=0}}$ - Variation of $C_{y_{\alpha=0}}$ presented as a function of $C_{LOCAL} K_{\Lambda_1}$

MER STA 1 - Figure 349

MER STA 2 - Figure 349

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Wing sweep correction factor, $\frac{\sin \Lambda}{\sin 45°}$, where $\Lambda$ is the aircraft quarter-chord wing sweep angle.

MER STATIONS 4 and 6 (MS4,6):

$$\left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ PRED \\ MS4,6}} = \left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ PRED_{℄} \\ MS4,6}} + \Delta C_{y_{\substack{\alpha=0 \\ MS4,6}}} K_{SCALE_{SF}} K_{\Lambda_1}$$

where

$\left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ PRED_{℄}}}$ - Value predicted for fuselage centerline-mounted stores, defined above, $ft^2$.

$\Delta C_{y_{\alpha=0}}$ - Variation of $C_{y_{\alpha=0}}$ based on $\frac{\ell_{LE_F}}{C_{LOCAL}}$ defined as the distance from the wing leading edge to the nose of the store on MER STA 2 measured in a wing plan view divided by the local wing chord, positive, Figure 350.

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Defined above.

MER STATIONS 3 and 5 (MS3,5):

$$\left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ PRED \\ MS3,5}} = \left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ PRED_{\mathbb{C}} \\ MS3,5}} + \Delta C_{y_{\substack{\alpha=0 \\ MS3,5}}} K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ PRED_{\mathbb{C}}}}$ - Value predicted for fuselage centerline-mounted stores, defined above, $ft^2$.

$\Delta C_{y_{\alpha=0}}$ - Incremental $C_{y_{\alpha=0}}$ for wing-mounted stores presented as a function of $C_{LOCAL} K_{\Lambda_1}$, Figure [illegible].

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Defined above

**Example:** Compute the side force intercept, $\left(\frac{SF}{q}\right)_{\alpha=0}$, for an M117 store on MER STATION 6 of a fully loaded MER on the A-7 center pylon at $M = 0.5$.

Required for Computation:

$C_{LOCAL} = 127.6$ in.

$\ell_{LE_F} = 59.3$ in.

$d = 16.1$ in.

$S_{REF} = 1.42\ ft^2$.

$\left(\frac{SF}{q}\right)_{\psi_{ISO}} = .114\ \frac{ft^2}{deg}$

$SPA = 1200\ in^2$.

$K_{\Lambda_1} = \frac{\sin 35^\circ}{\sin 45^\circ} = .811$

$$C_{y_{\alpha=0}} = .174 \text{ - Figure 348}$$
$$\underset{MS6}{\text{℄}}$$

then

$$\left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ PRED_{℄} \\ MS6}} = (.174)(1.42) = .247 \text{ ft}^2.$$

$$\Delta C_{y_{\substack{\alpha=0 \\ MS6}}} = -.23 \text{ - Figure 350}$$

Substituting,

$$\left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ PRED \\ MS6}} = .247 + (-.23)\frac{(.114)(1200)}{96}(.811)$$
$$= -.019 \text{ ft}^2.$$

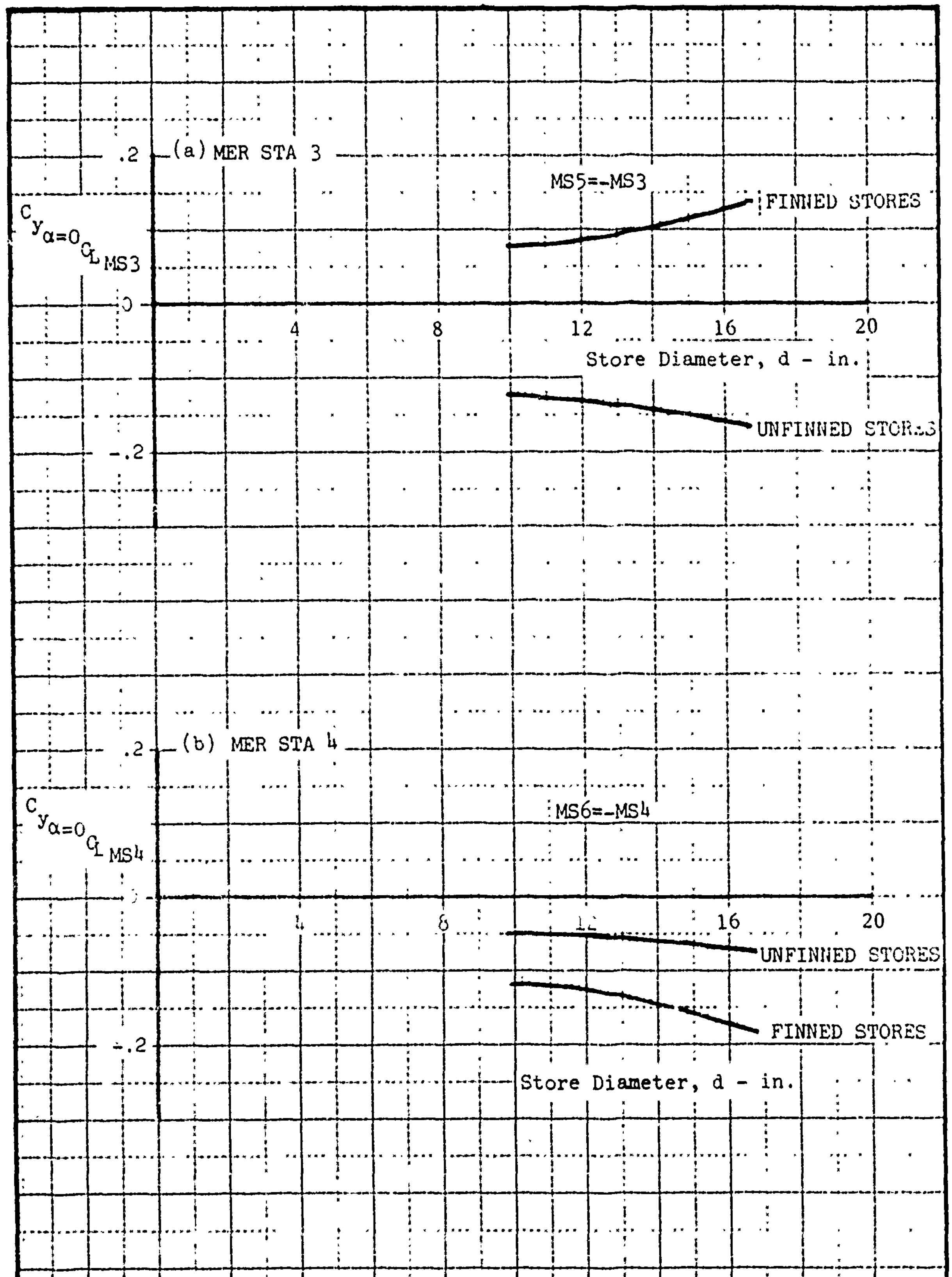



Figure 348. Side Force Intercept - Stores Mounted on Fuselage Centerline, MER Stations 3-6

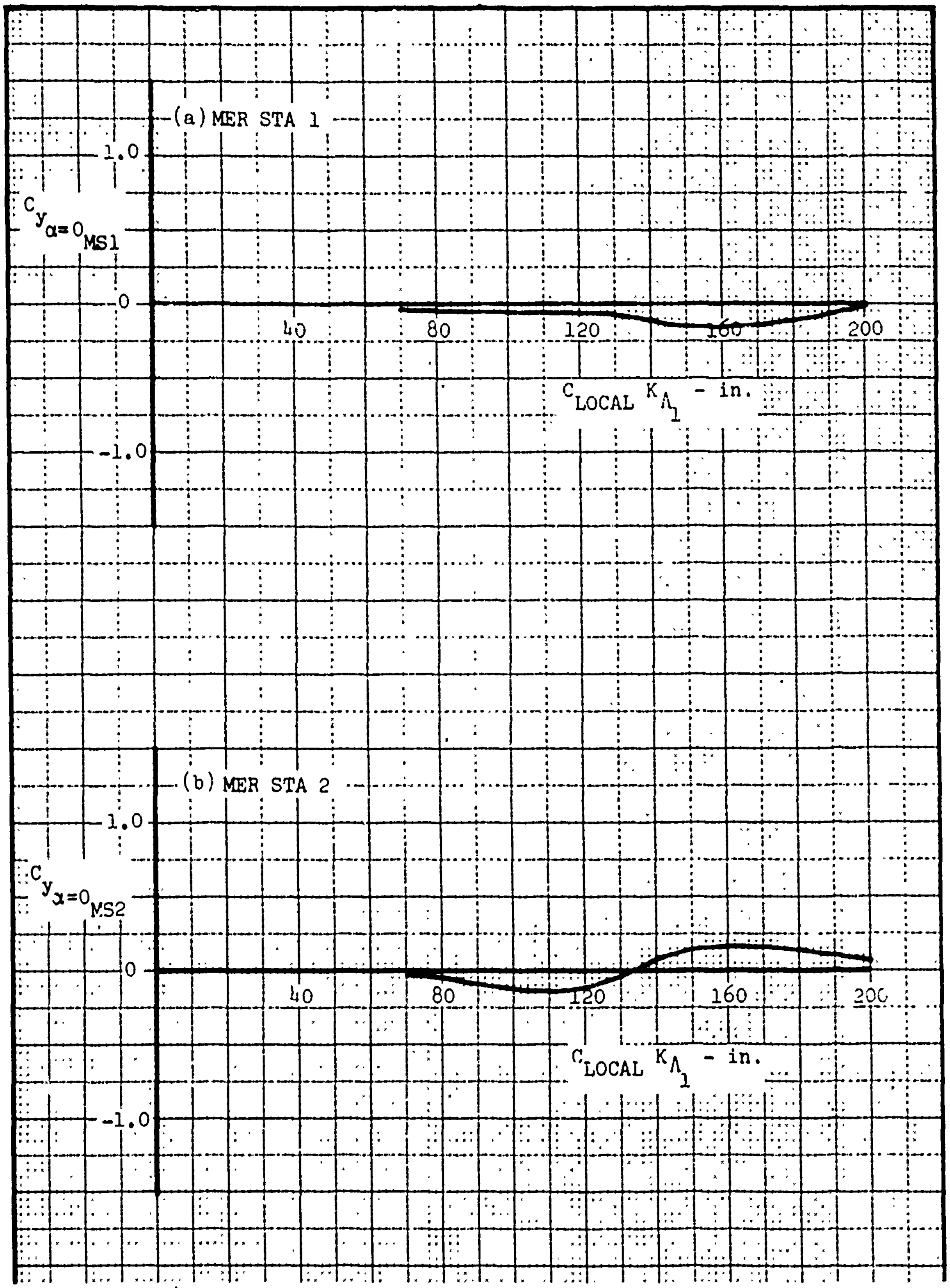



Figure 349. Side Force Intercept - Incremental Coefficient for Wing-Mounted Stores, MER Stations 1 and 2

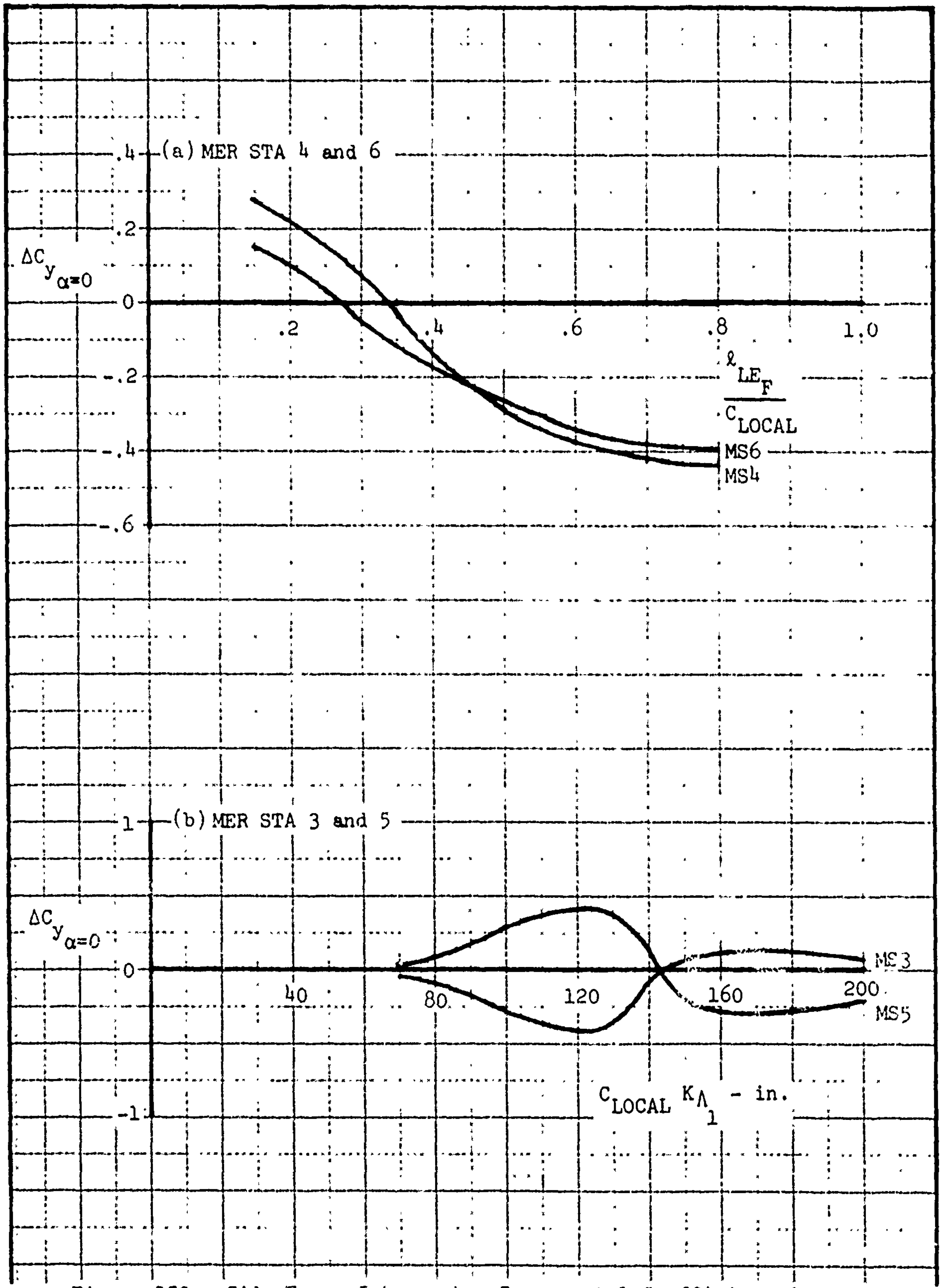



Figure 350. Side Force Intercept - Incremental Coefficient for Wing-Mounted Stores, MER Stations 3-6

### 4.1.1.4 Intercept Mach Number Correction

To compute the variation in side force intercept, $\left(\frac{SF}{q}\right)_{\alpha=0}$, between M = 0.5 and M = 1.6 use the following expression.

$$\left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ M = x}} = \left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ PRED}} + \Delta\left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ M = x}}$$

where:

$\left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ PRED}}$ - Side force intercept predicted at M = 0.5.

$\Delta\left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ M = x}}$ - Increment in side force intercept at M = x.

FUSELAGE CENTERLINE-MOUNTED STORES

MER STATIONS 1 and 2 (MS1,2):

$$\left(\frac{SF}{q}\right)_{\substack{\alpha=0_{\text{℄}} \\ M = x \\ MS1,2}} = 0, \text{ due to symmetry}$$

MER STATIONS 3, 4, 5 and 6 (MS3-6):

$$\left(\frac{SF}{q}\right)_{\substack{\alpha=0_{\text{℄}} \\ M = x \\ MS3-6}} = \left(\frac{SF}{q}\right)_{\substack{\alpha=0_{\text{℄}} \\ PRED \\ MS3-6}} + \Delta C_{y_{\substack{\alpha=0_{\text{℄}} \\ MS3-6}}} * SCALE_{SF}$$

where:

$\left(\frac{SF}{q}\right)_{\substack{\alpha=0_{\text{℄}} \\ PRED \\ MS3-6}}$ - Intercept predicted for fuselage centerline stores at M = 0.5, Subsection 4.1.1.3.

$\Delta C_{y_{\alpha=0_{\varepsilon}}}$ - Incremental side force intercept presented as a function of Mach number, Figure 352.

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

WING-MOUNTED STORES

A generalized curve depicting the side force intercept variation with Mach number is given by Figure 351.

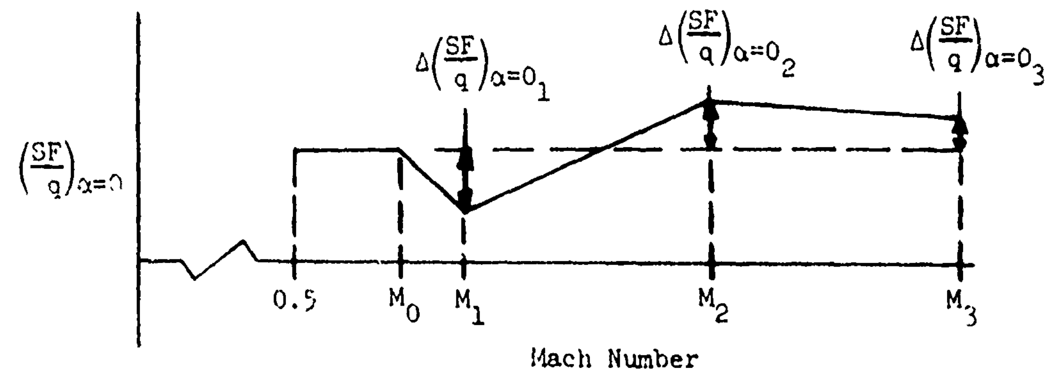



Figure 351. Side Force Intercept - Generalized Mach Number Variation

The side force intercept variation with Mach number has been approximated by a series of linear segments with break points occurring at Mach numbers defined by $M_0$, $M_1$, $M_2$, and $M_3$ for each of the six MER stations. The variations of the Mach break points are presented in Figure 353 (MS1, 2), Figure 354 (MS4,6), and Figure 355 (MS3,5) as a function of $C_{LOCAL}K_{\Lambda_1}$. $M_0$ is the Mach number where the intercept initially deviates from the intercept predicted at $M = 0.5$. Equations have been developed to predict the delta (incremental) slope change from that predicted at $M = 0.5$ for each of the six MER stations. These equations are presented below.

Break 1 ($M_1$):

MER STATION 1 (MS1):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha=0_{1}\,MS1} = \left(\Delta C_{y_{\alpha=0_{1}\,MS1}} + \Delta C_{y_{\alpha=0_{1}\,\frac{\ell_{LE_F}}{C}\,MS1}} + \Delta C_{y_{\alpha=0_{1}\,INTF\,MS1}}\right) K_{SCALE_{SF}} K_{\Lambda_1}$$

where

$\Delta C_{y_{\alpha=0_1}}$ - incremental $C_{y_{\alpha=0}}$ at $M = M_1$ presented as a function of $C_{LOCAL} K_{\Lambda_1}$, Figure 356.

$\Delta C_{y_{\alpha=0_1\,\frac{\ell_{LE_F}}{C}}}$ - Increment in $C_{y_{\alpha=0}}$ based on the distance from the wing leading edge to the nose of the store on MER STA 2 measured in a wing plan view divided by the local wing chord, positive, Figure 357.

$\Delta C_{y_{\alpha=0_1\,INTF}}$ - Incremental $C_{y_{\alpha=0}}$ due to the interference effect of the fuselage for high wing aircraft, Figure 358.

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Wing sweep correction factor, $\frac{\sin \Lambda}{\sin 45^\circ}$, where $\Lambda$ is the quarter chord sweep angle of the aircraft wing.

MER STATIONS 2,3,4, and 5 (MS2-5):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha=0_1\,MS2-5} = \Delta C_{y_{\alpha=0_1}\,MS2-5} \, K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha=0_1}}$ - Incremental $C_{y_{\alpha=0}}$ at $M = M_1$ presented as a function of $C_{LOCAL}K_{\Lambda_1}$.

MER STA 2 - Figure 358

MER STA 3 - Figure 359

MER STA 4 - Figure 360

MER STA 5 - Figure 359

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Defined above

MER STATION 6 (MS6):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha=0_1\,MS6} = \left(\Delta C_{y_{\alpha=0_1}\,MS6} + \Delta C_{y_{\alpha=0_1}\,INTF\,MS6}\right) K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha=0_1}}$ - Incremental $C_{y_{\alpha=0}}$ at $M = M_1$ presented as a function of $C_{LOCAL}K_{\Lambda_1}$, Figure 360.

$\Delta C_{y_{\alpha=0_1}\,INTF}$ - Incremental $C_{y_{\alpha=0}}$ due to the interference effect of the fuselage for high wing aircraft, Figure 361.

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Defined above.

Break 2 ($M_2$):

MER STATIONS 1,2,3, and 5 (MS1,2,3,5):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha=0_{2}\,MS1,2,3,5} = \left(\Delta C_{y_{\alpha=0_{2}}\,MS1,2,3,5} + \Delta C_{y_{\alpha=0_{2}}\,INTF\,MS1,2,3,5} + \Delta C_{y_{\alpha=0_{2}}\,\frac{\ell_{LE_F}}{C}\,MS1,2,3,5}\right) K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha=0_2}}$ - Incremental $C_{y_{\alpha=0}}$ at $M = M_2$ presented as a function of $C_{LOCAL}K_{\Lambda_1}$.

MER STA 1 - Figure 362

MER STA 2 - Figure 362

MER STA 3 - Figure 365

MER STA 5 - Figure 365

$\Delta C_{y_{\alpha=0_2}\,INTF}$ - Incremental $C_{y_{\alpha=0}}$ due to the interference effect of the fuselage for high wing aircraft.

MER STA 1 - Figure 364

MER STA 2 - Figure 364

MER STA 3 - Figure 367

MER STA 5 - Figure 367

$\Delta C_{y_{\alpha=0_2}\,\frac{\ell_{LE_F}}{C}}$. - Incremental $C_{y_{\alpha=0}}$ based on the distance from the wing leading edge to the nose of the store on MER STA 2 measured in a wing plan

view divided by the wing local chord, positive.

MER STA 1 - Figure 363

MER STA 2 - Figure 363

MER STA 3 - Figure 366

MER STA 5 - Figure 366

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Defined under Break 1, MS1.

MER STATIONS 4 and 6 (MS4,6):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha=0_{2}\,MS4,6} = \Delta C_{y_{\alpha=0_{2}}\,MS4,6} K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha=0_2}}$ - Incremental $C_{y_{\alpha=0}}$ at $M = M_2$ presented as a function of $C_{LOCAL} K_{\Lambda_1}$

MER STA 4 - Figure 368

MER STA 6 - Figure 368

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Defined under Break 1, MS1.

BREAK 3 ($M_3$):

MER STATION (MS1):

No break 3

MER STATION 2 (MS2):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha=0_{3}\,MS2} = \left(\Delta C_{y_{\alpha=0_{3}\,MS2}} + \Delta C_{y_{\alpha=0_{3}\,INTF\,MS2}} + \Delta C_{y_{\alpha=0_{3}\,\frac{\ell_{LE_F}}{C}\,MS2}}\right) K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha=0_3}}$ - Incremental $C_{y_{\alpha=0}}$ at $M = M_3$ presented as a function of $C_{LOCAL}K_{\Lambda_1}$, Figure 369.

$\Delta C_{y_{\alpha=0_3\,INTF}}$ - Incremental $C_{y_{\alpha=0}}$ due to the interference effect of the fuselage for high wing aircraft, Figure 371.

$\Delta C_{y_{\alpha=0_3\,\frac{\ell_{LE_F}}{C}}}$ - Increment in $C_{y_{\alpha=0}}$ based on the distance from the wing leading edge to the nose of the store on MER STA 2 measured in a wing plan view divided by the local wing chord, positive, Figure 370.

MER STATIONS 4 and 6 (MS4,6):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha=0_{3}\,MS4,6} = \Delta C_{y_{\alpha=0_{3}\,MS4,6}} K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha=0_3}}$ - Incremental $C_{y_{\alpha=0}}$ at $M = M_3$ presented as a function of $C_{LOCAL}K_{\Lambda_1}$.

MER STA 4 - Figure 372

MER STA 6 - Figure 372

MER STATIONS 3 and 5 (MS3,5):

$$\Delta\left(\frac{SF}{q}\right)_{\substack{\alpha=0_3\\ MS3,5}} = \left(\Delta C_{y_{\alpha=0_3}}{}_{MS3,5} + \Delta C_{y_{\alpha=0_3}}{}_{\substack{INTF\\ MS3,5}}\right) K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha=0_3}}$ - Incremental $C_{y_{\alpha=0}}$ at $M = M_3$ presented as a function of $C_{LOCAL} K_{\Lambda_1}$.

MER STA 3 - Figure 373

MER STA 5 - Figure 373

$\Delta C_{y_{\alpha=0_3}}{}_{INTF}$ - Incremental $C_{y_{\alpha=0}}$ due to the interference effect of the fuselage for high wing aircraft.

MER STA 3 - Figure 374

MER STA 5 - Figure 374

To compute $\left(\frac{SF}{q}\right)_{\alpha=0}$ at M = x, first determine from Figures 353, 354, or 355 (for the MER station of interest) between which Mach number break points M = x occurs. Let $M_{LOW}$ be the lower Mach break and $M_{HI}$ be the higher Mach break. Compute $\left(\frac{SF}{q}\right)_{\alpha=0}$ at M = x from the expression below.

MER STATIONS 1 - 6 (MS1-6):

$$\left(\frac{SF}{q}\right)_{\substack{\alpha=0\\ M=x\\ MS1-6}} = \left(\frac{SF}{q}\right)_{\substack{\alpha=0\\ PRED\\ MS1-6}} + \Delta\left(\frac{SF}{q}\right)_{\substack{\alpha=0\\ M_{LOW}\\ MS1-6}} + \left(\frac{x - M_{LOW}}{M_{HI} - M_{LOW}}\right) \left[\Delta\left(\frac{SF}{q}\right)_{\substack{\alpha=0\\ M_{HI}\\ MS1-6}} - \Delta\left(\frac{SF}{q}\right)_{\substack{\alpha=0\\ M_{LOW}\\ MS1-6}}\right]$$

If $x \le M_0$, $\left(\frac{SF}{q}\right)_{\substack{\alpha=0 \\ M=x}}$ will be the value obtained in Subsection 4.1.1.3 (the initial term in the above equation).

An example illustrating the application of the above equation is found in subsection 4.1.1.2.

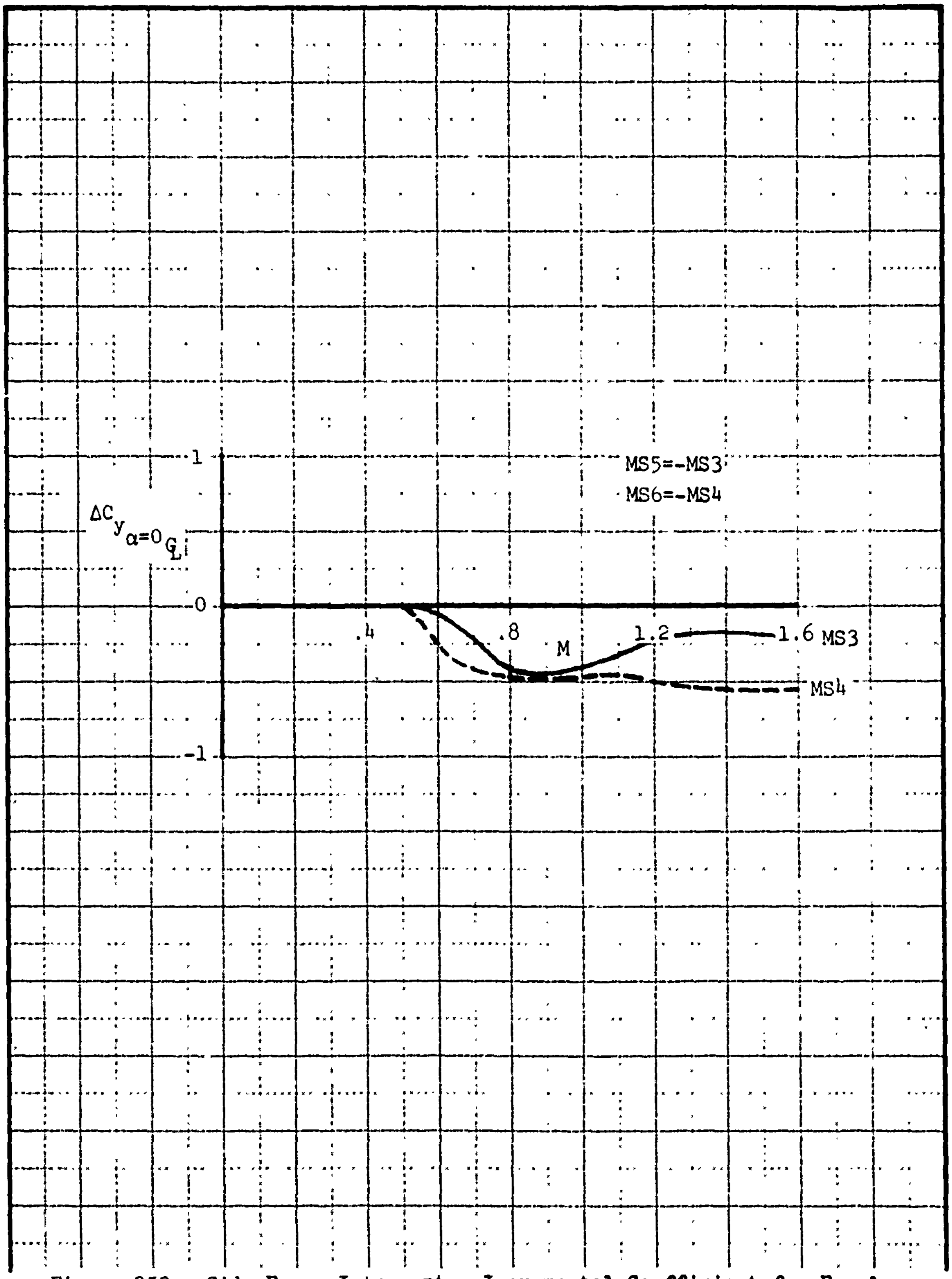



Figure 352. Side Force Intercept - Incremental Coefficient for Fuselage Centerline-Mounted Stores, MER Stations 3-6

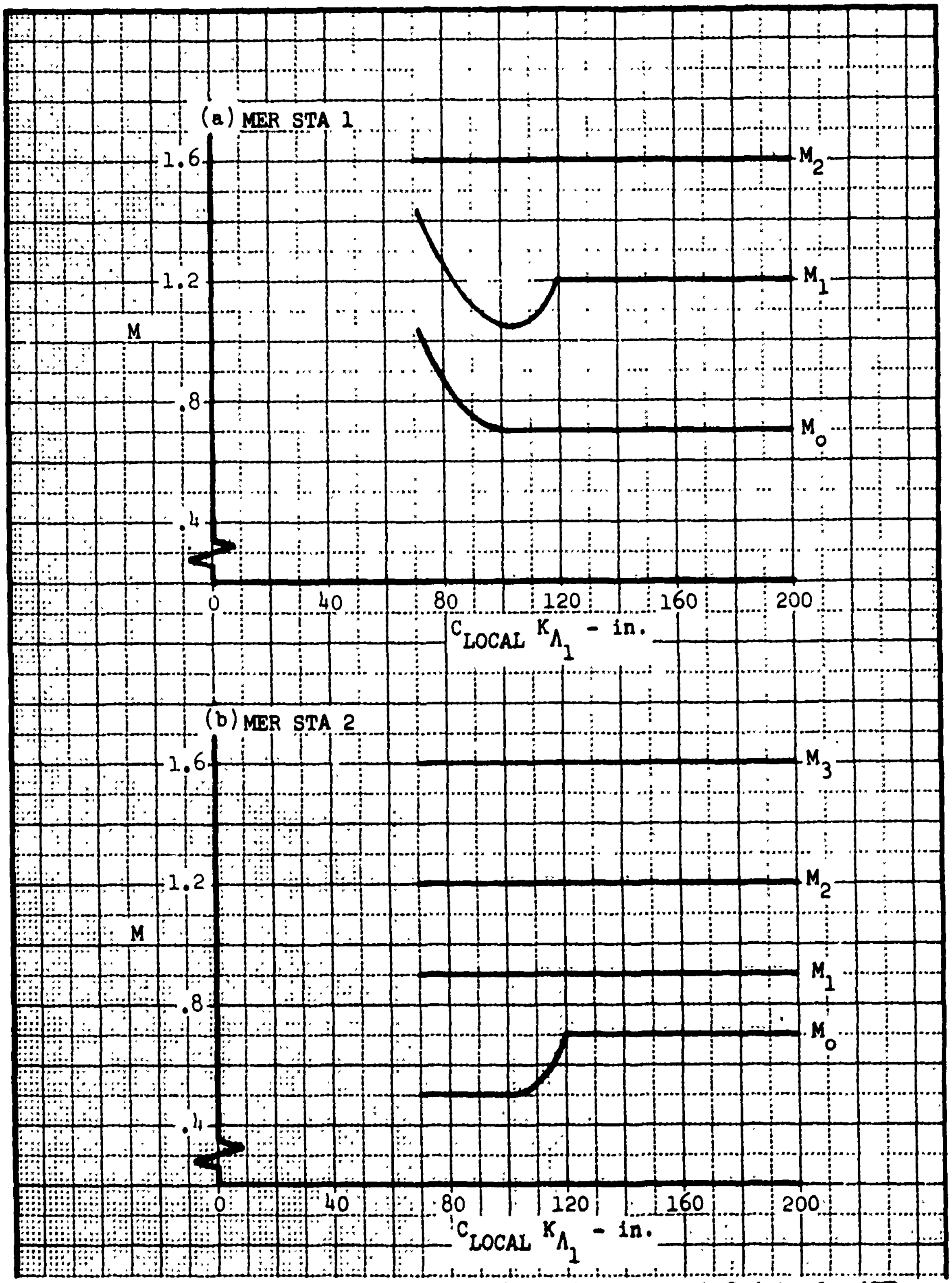



**Figure 353. Side Force Intercept - Mach Number Break Points for MER Stations 1 and 2**

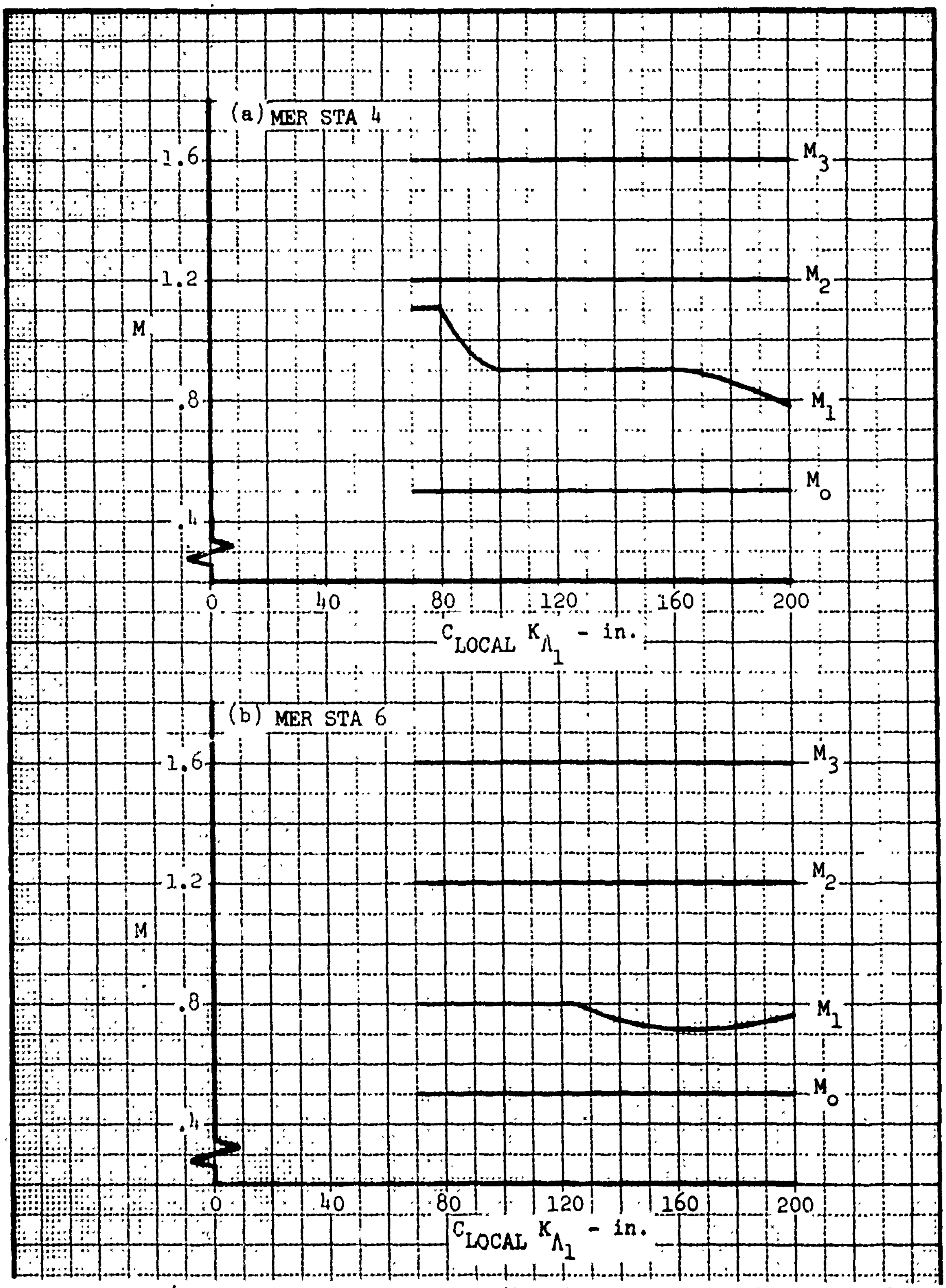



Figure 354. Side Force Intercept - Mach Number Break Points for MER Stations 4 and 6

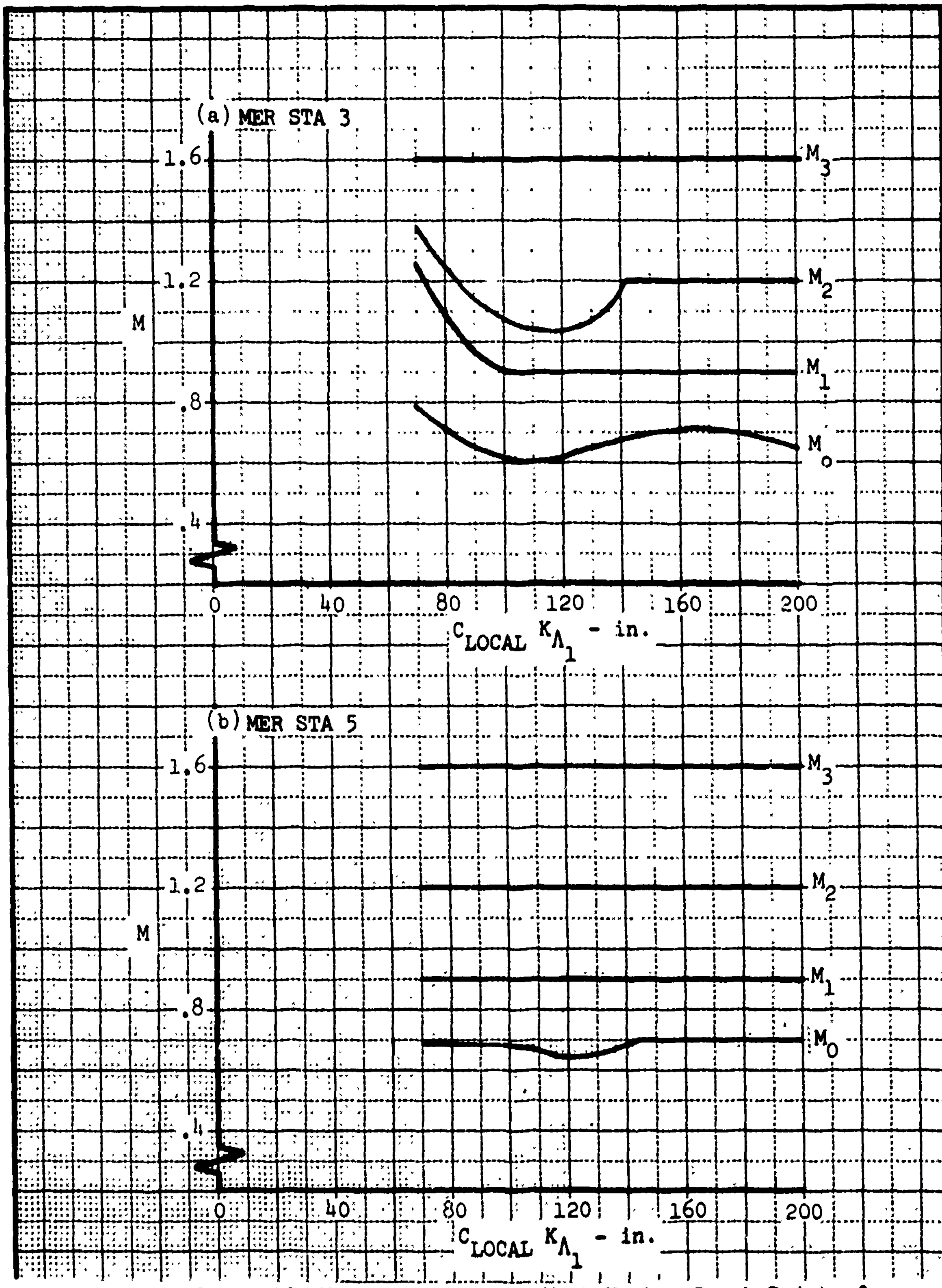



Figure 355. Side Force Intercept - Mach Number Break Points for MER Stations 3 and 5

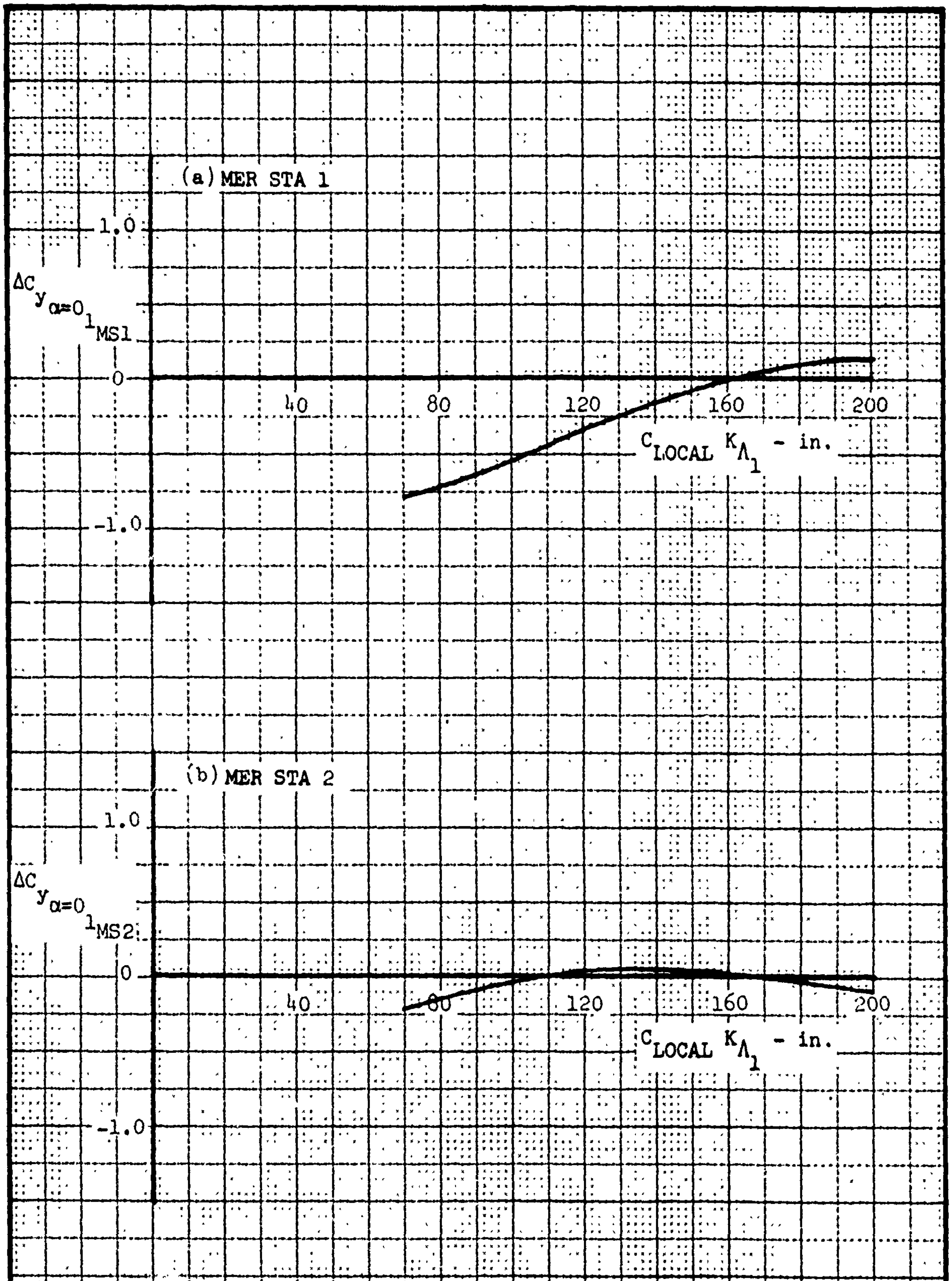



Figure 356. Side Force Intercept - Incremental Coefficient at Mach Break 1 for MER Stations 1 and 2

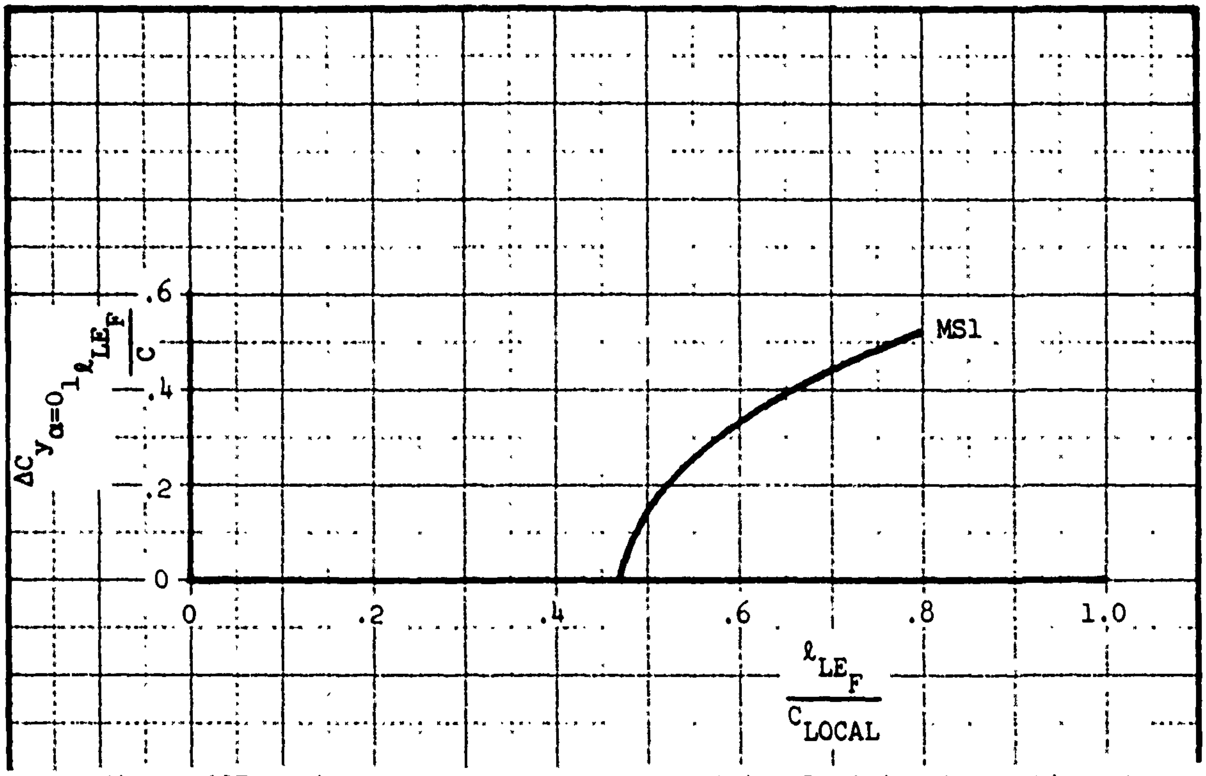



Figure 357. Side Force Intercept - Chordwise Position Correction at Mach Break 1 for MER Station 1

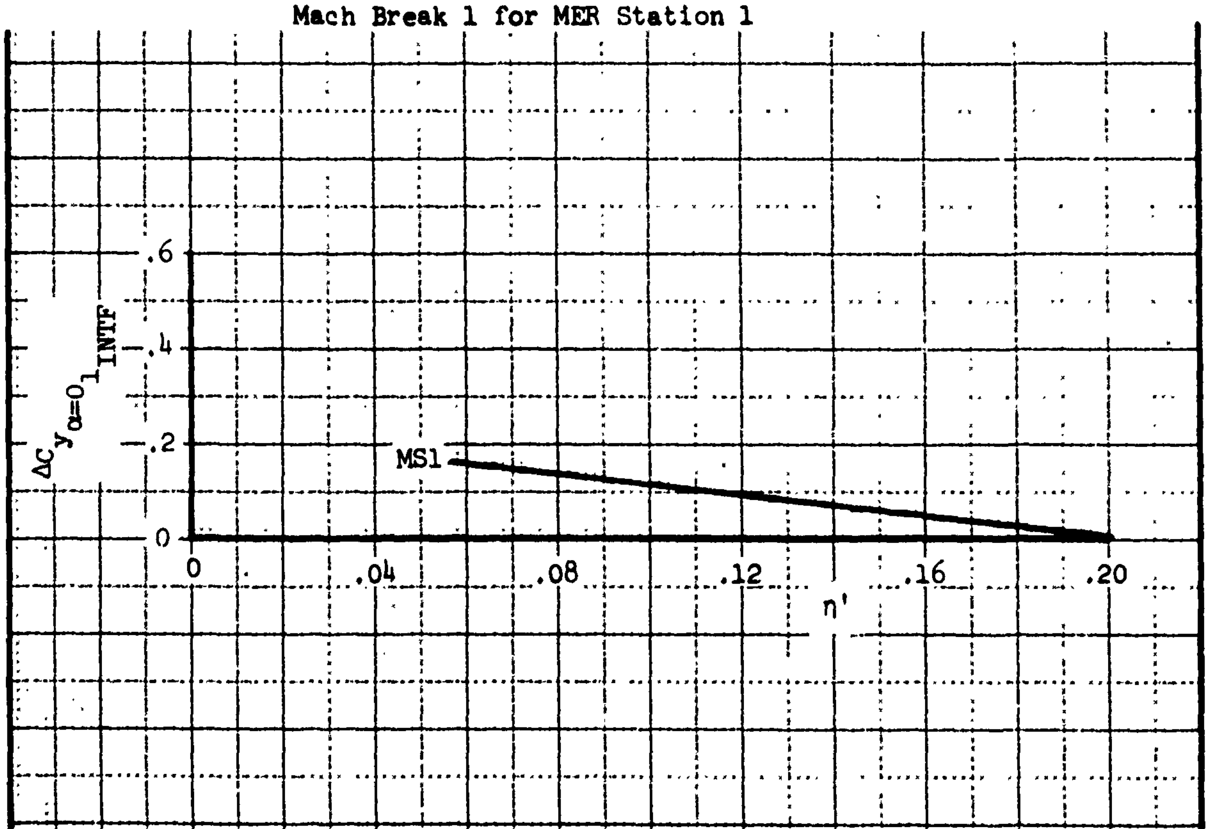



Figure 358. Side Force Intercept - Fuselage Interference Correction at Mach Break 1 for MER Station 1

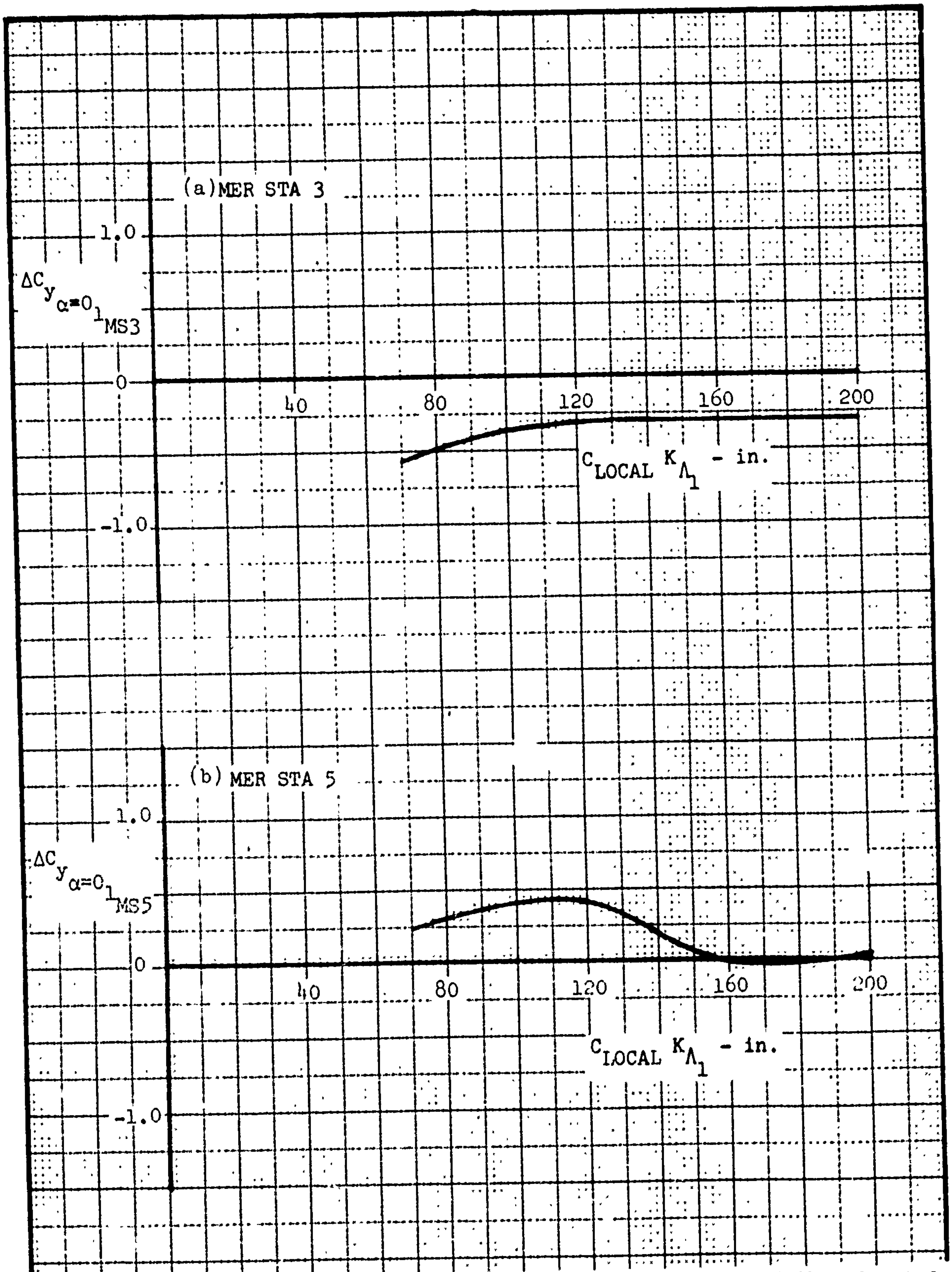



Figure 359. Side Force Intercept - Incremental Coefficient at Mach Break 1 for MER Stations 3 and 5

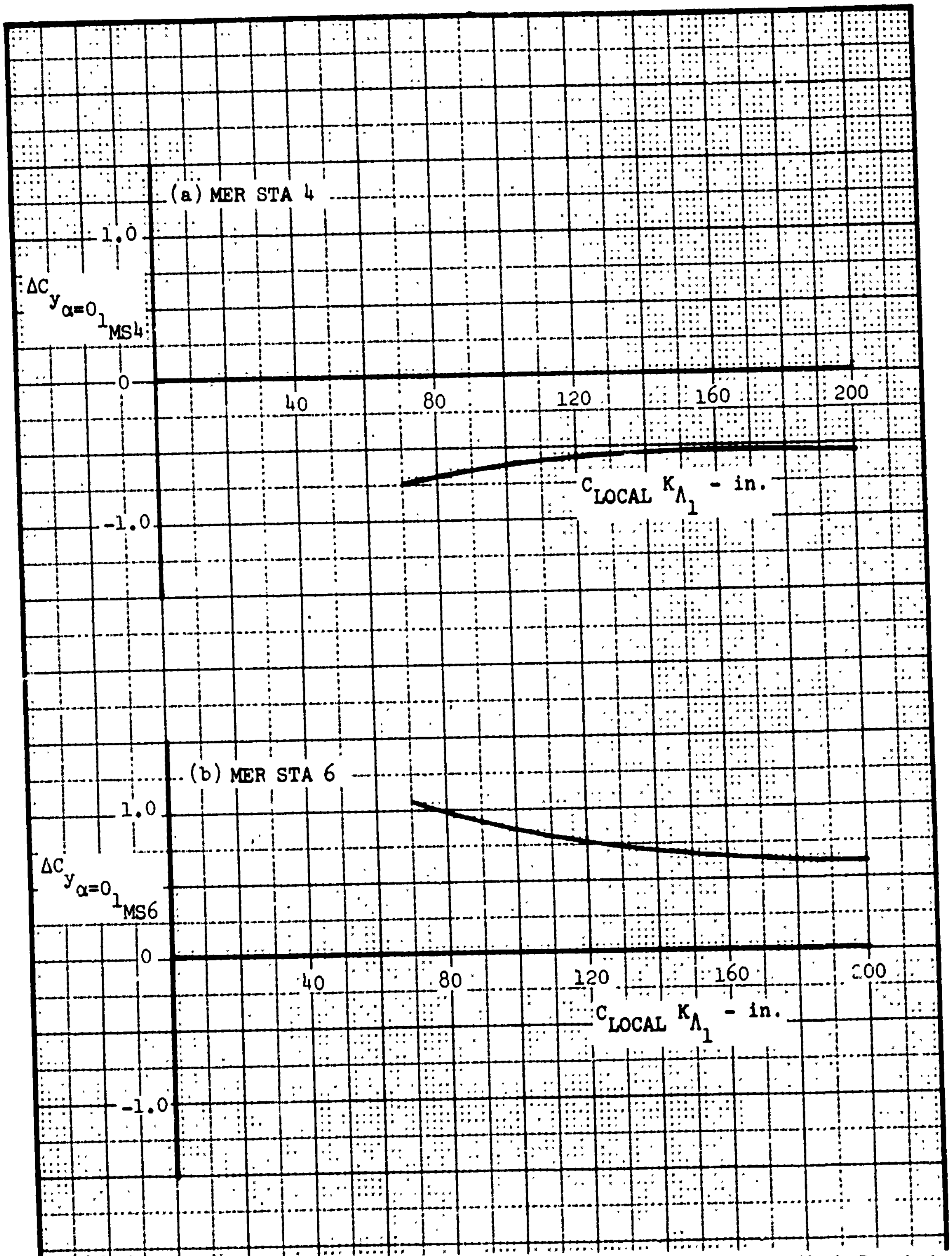



Figure 360. Side Force Intercept - Incremental Coefficient at Mach Break 1 for MER Stations 4 and 6

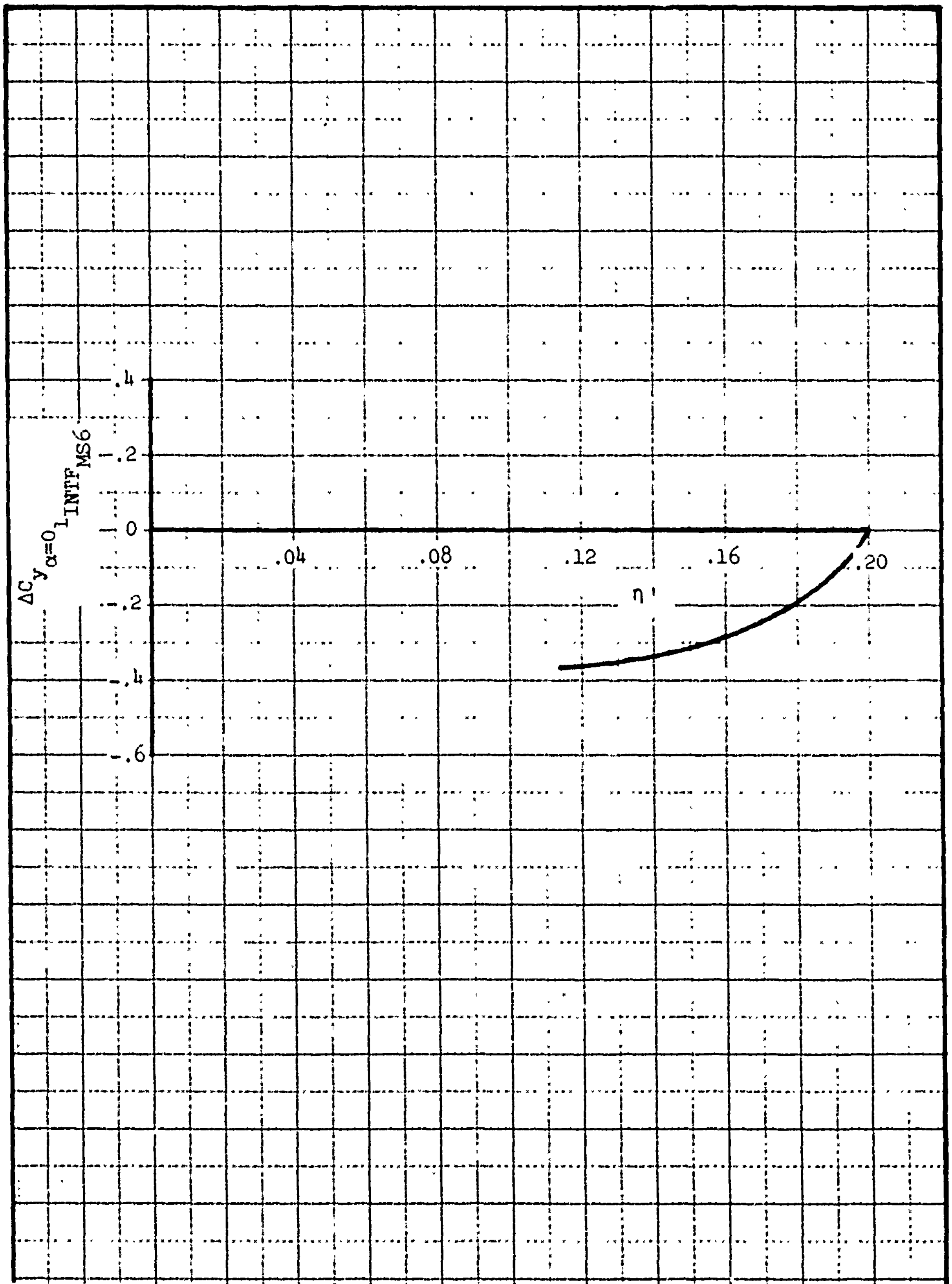



Figure 361. Side Force Intercept - Fuselage Interference Correction at Mach Break 1 for MER Station 6

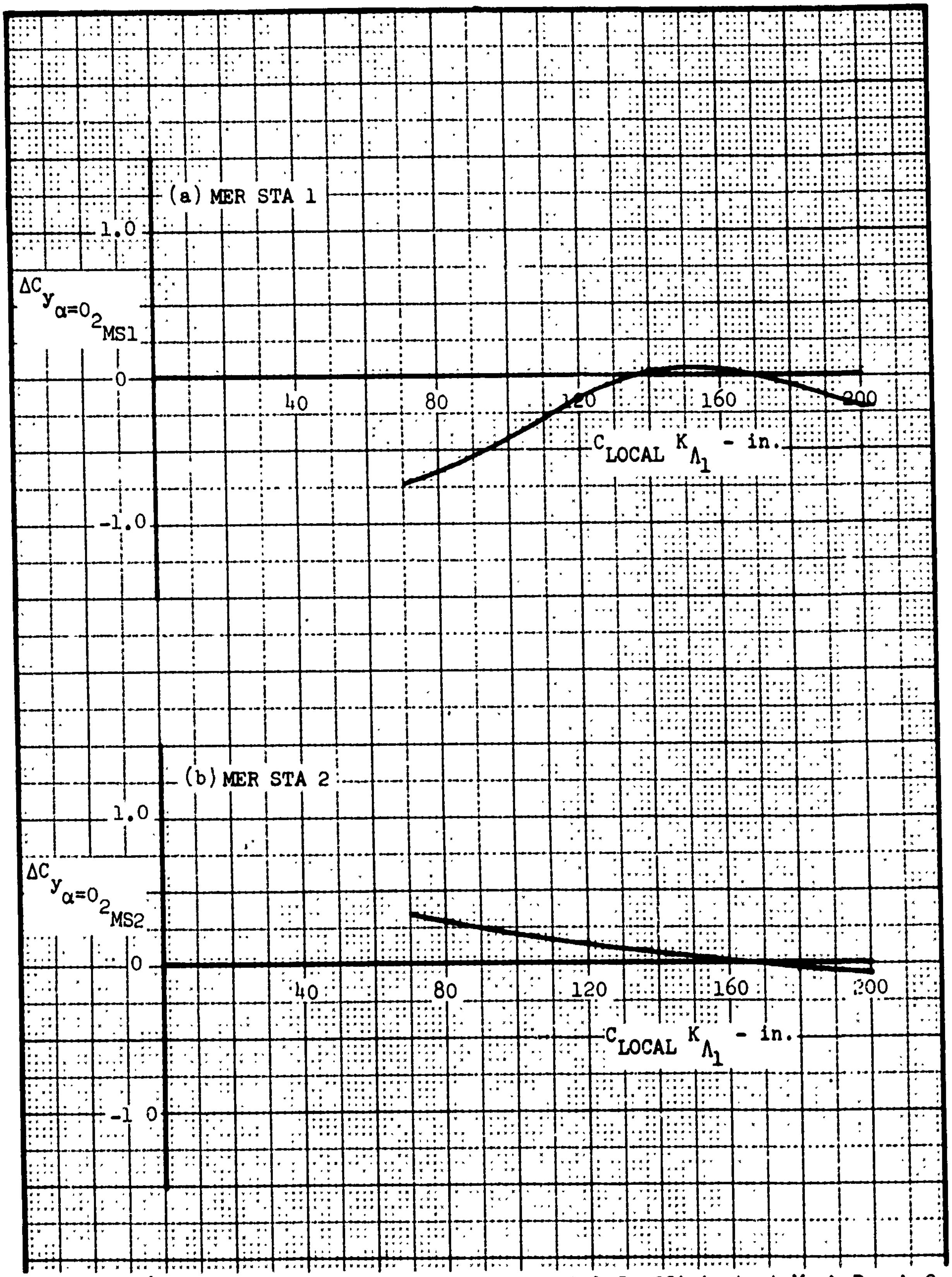



Figure 362. Side Force Intercept - Incremental Coefficient at Mach Break 2 for MER Stations 1 and 2

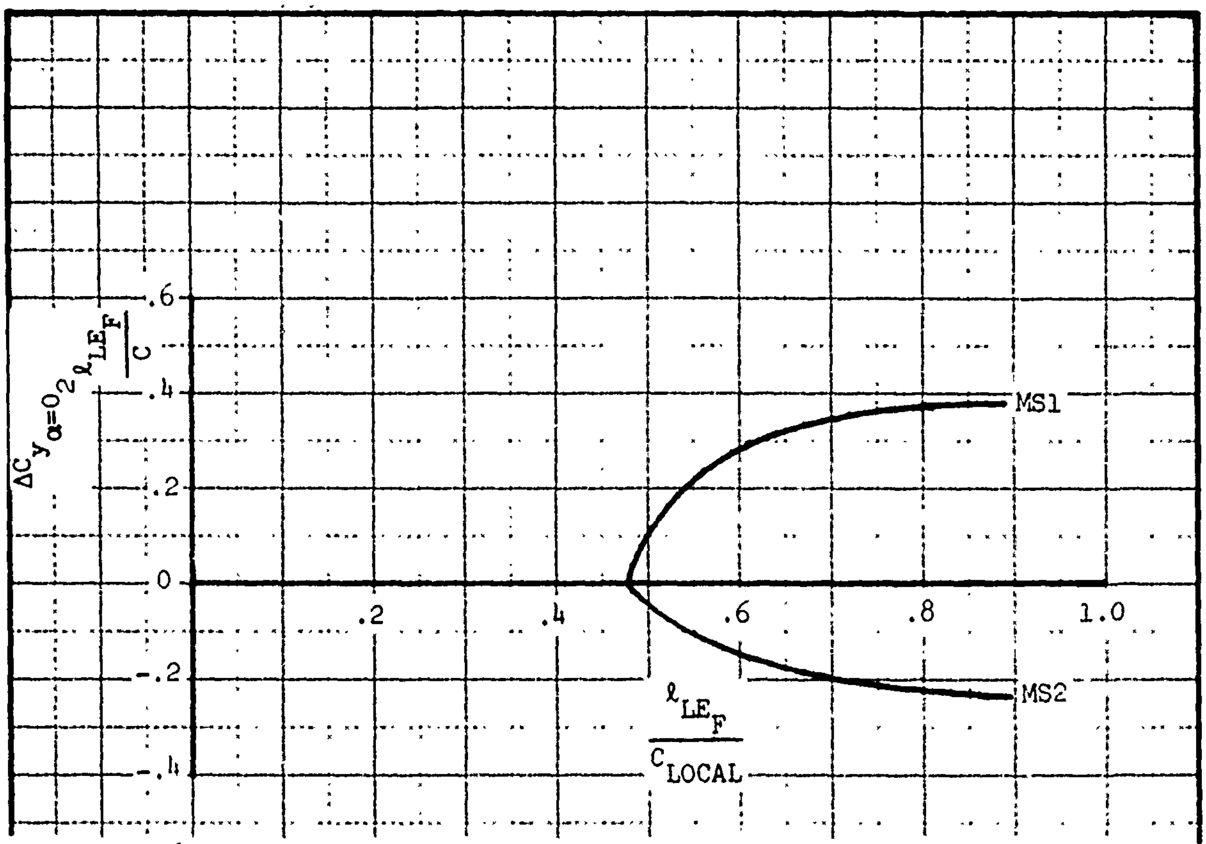



Figure 363. Side Force Intercept - Chordwise Position Correction at Mach Break 2 for MER Stations 1 and 2

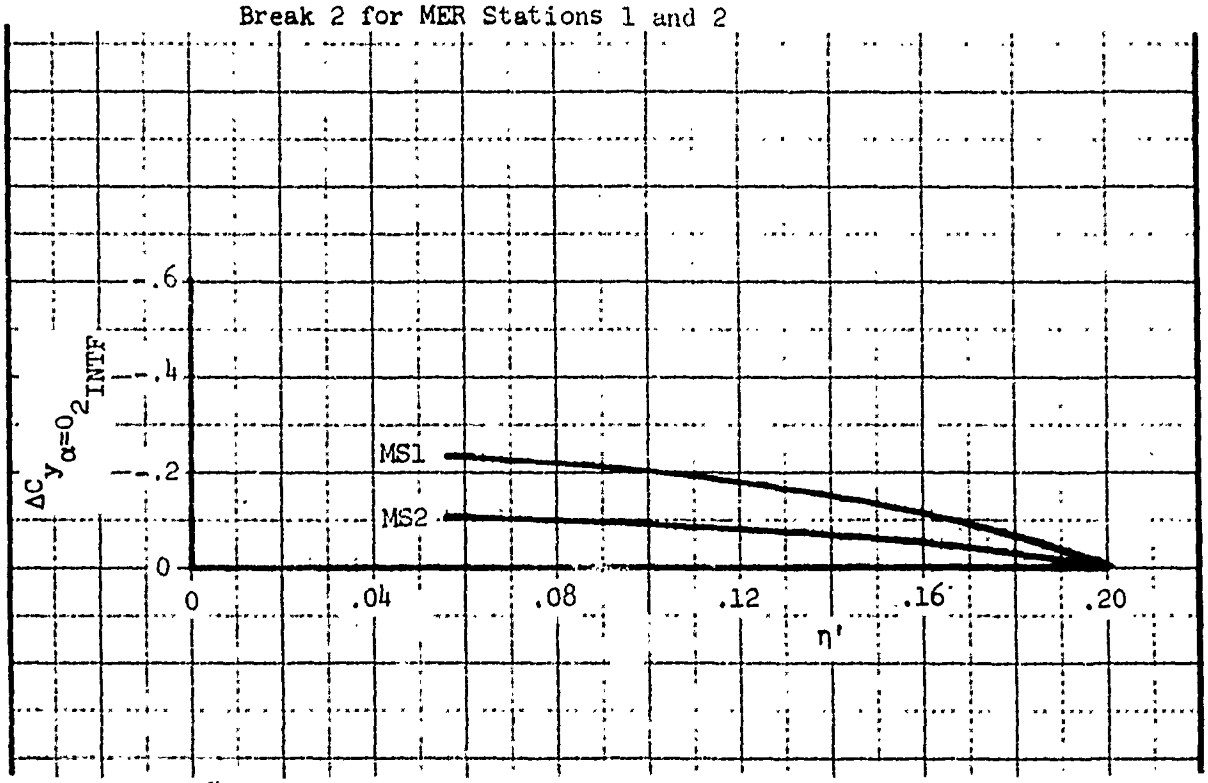



Figure 364. Side Force Intercept - Fuselage Interference Correction at Mach Break 2 for MER Stations 1 and 2

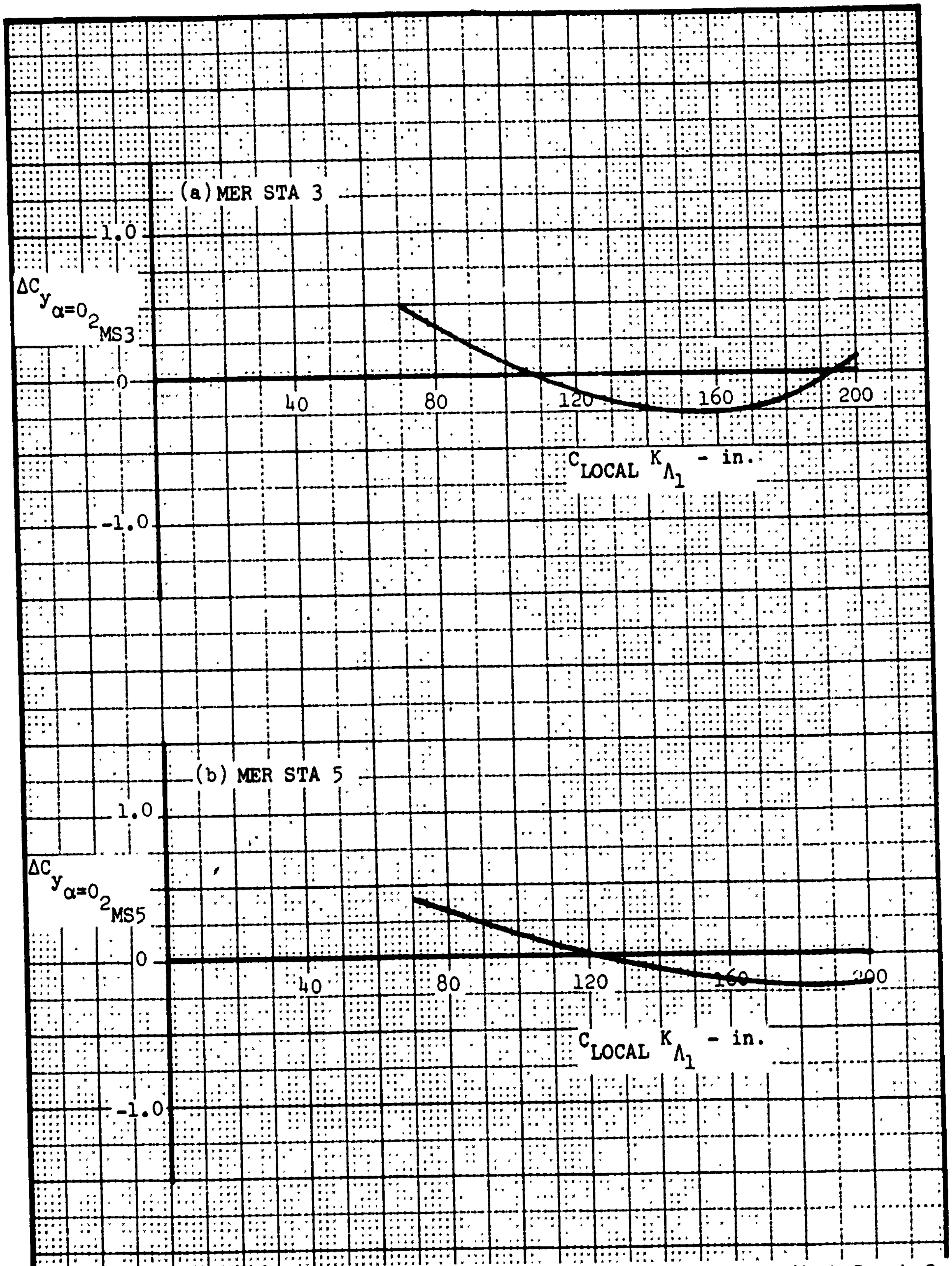



**Figure 365. Side Force Intercept - Incremental Coefficient at Mach Break 2 for MER Stations 3 and 5**

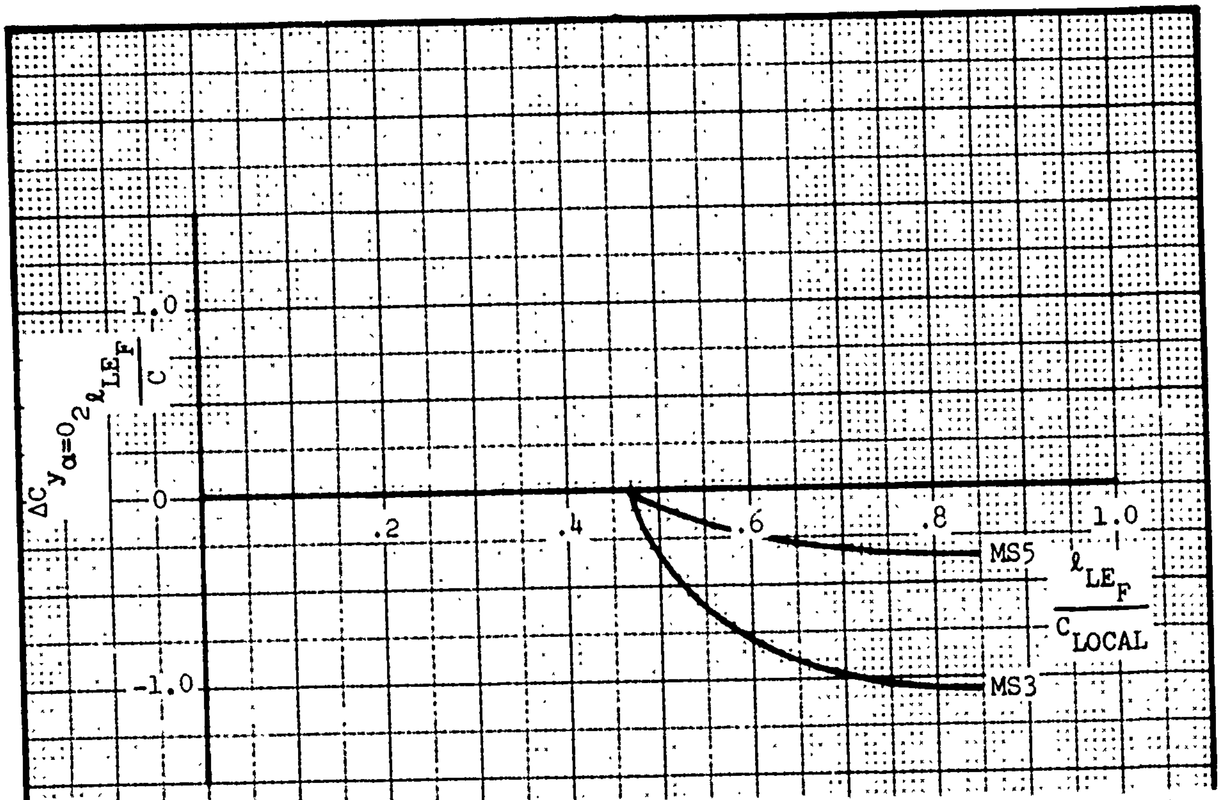



Figure 366. Side Force Intercept - Chordwise Position Correction at Mach Break 2 for MER Stations 3 and 5

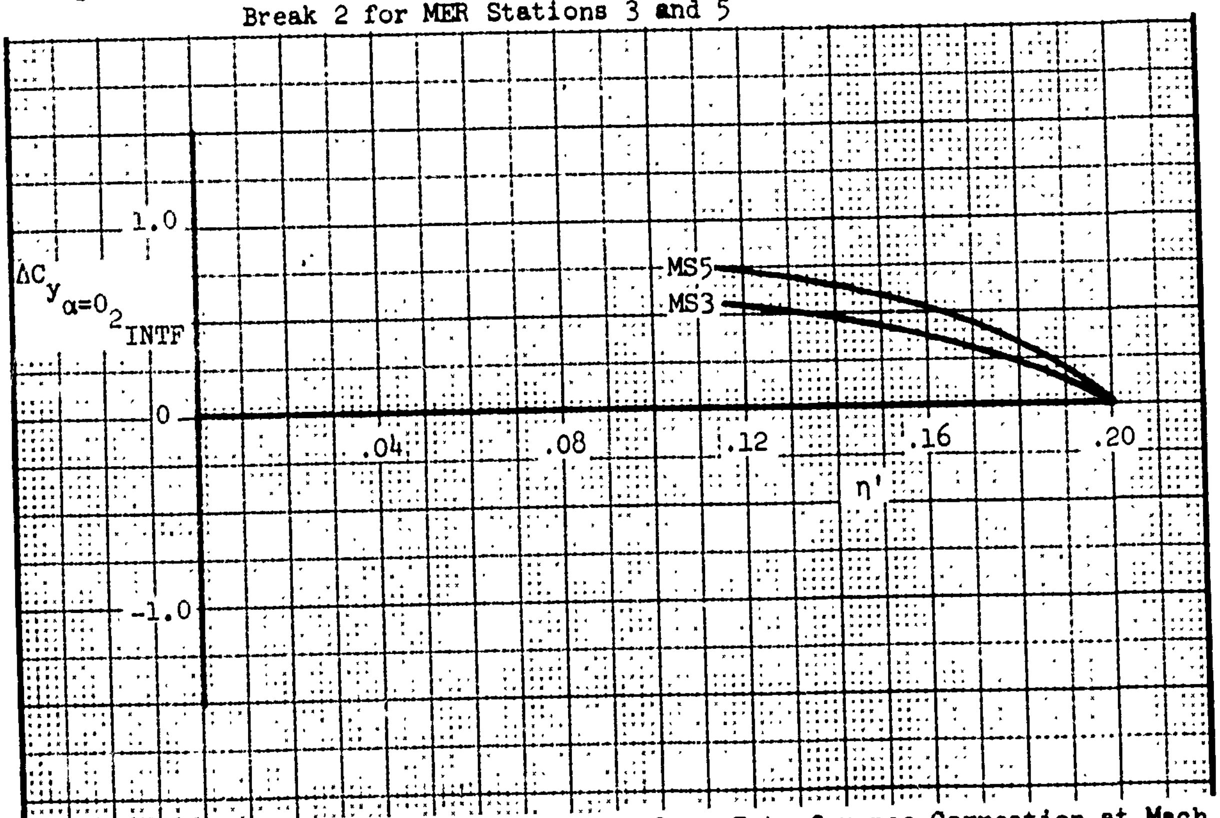



Figure 367. Side Force Intercept - Fuselage Interference Correction at Mach Break 2 for MER Stations 3 and 5

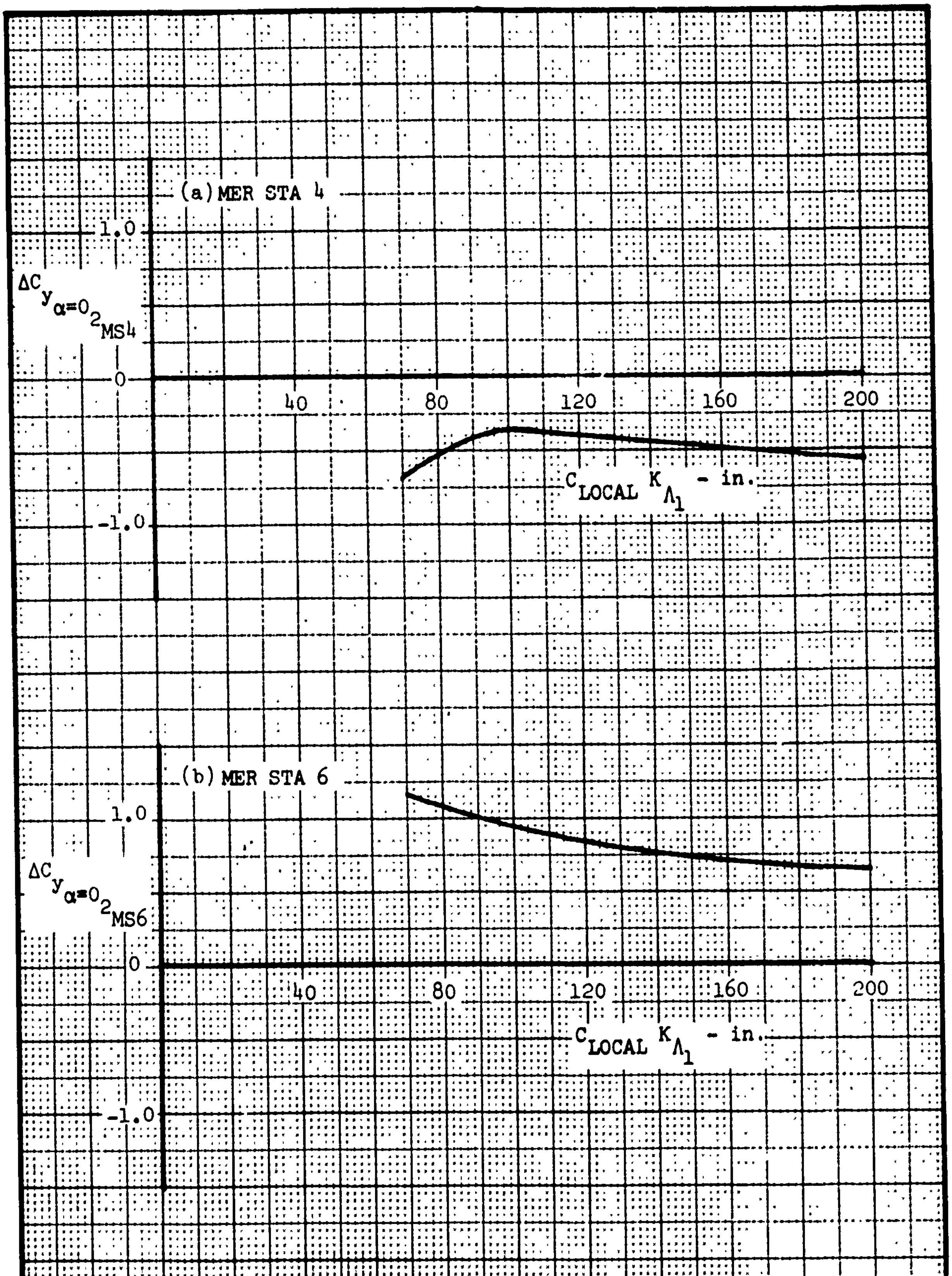



**Figure 368. Side Force Intercept - Incremental Coefficient at Mach Break 2 for MER Stations 4 and 6**

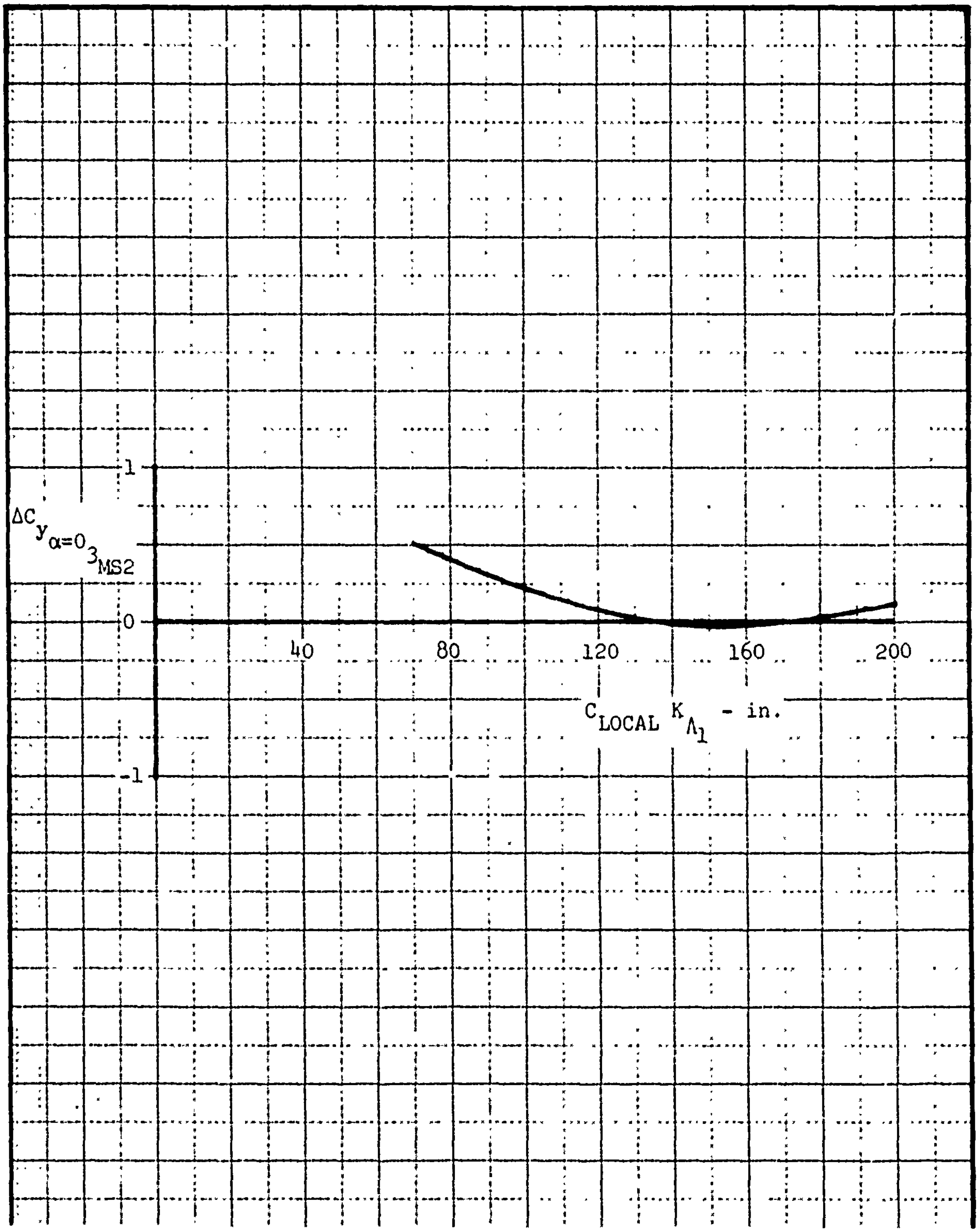



Figure 369. Side Force Intercept - Incremental Coefficient at Mach Break 3 for MER Station 2

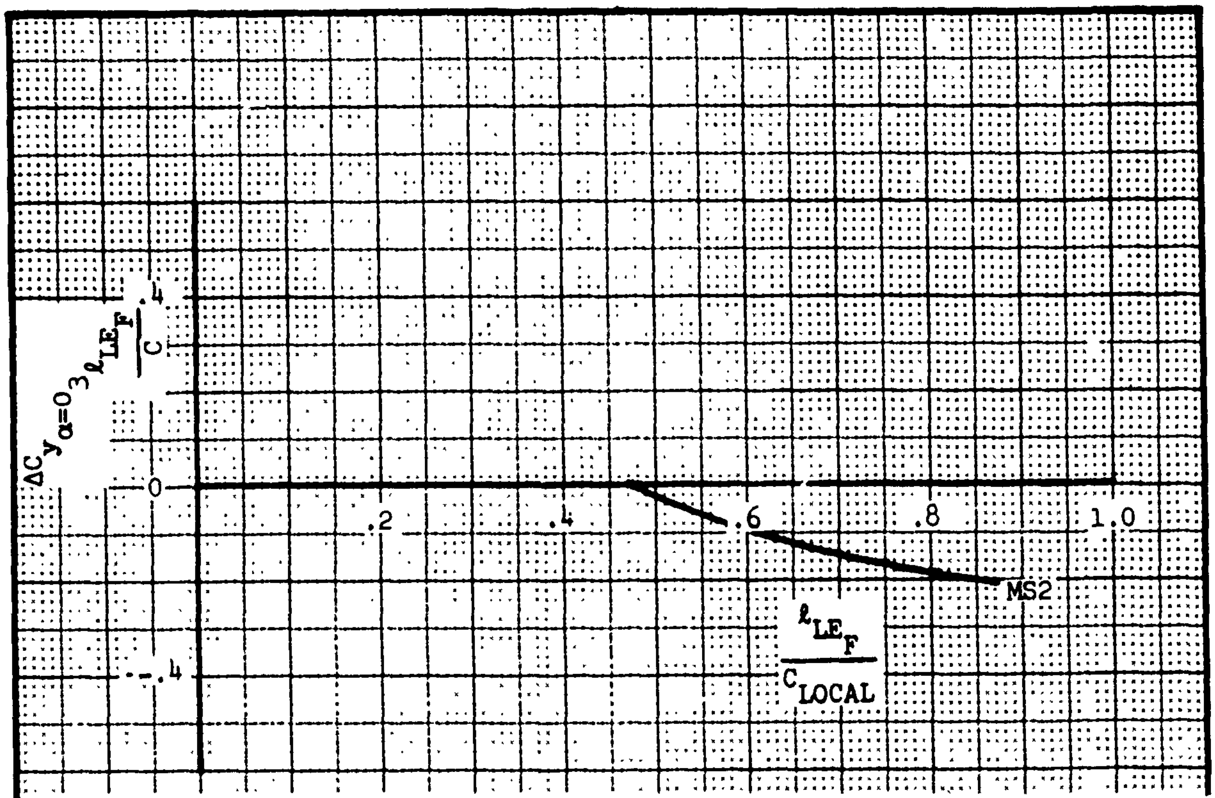



Figure 370. Side Force Intercept - Chordwise Position Correction at Mach Break 3 for MER Station 2

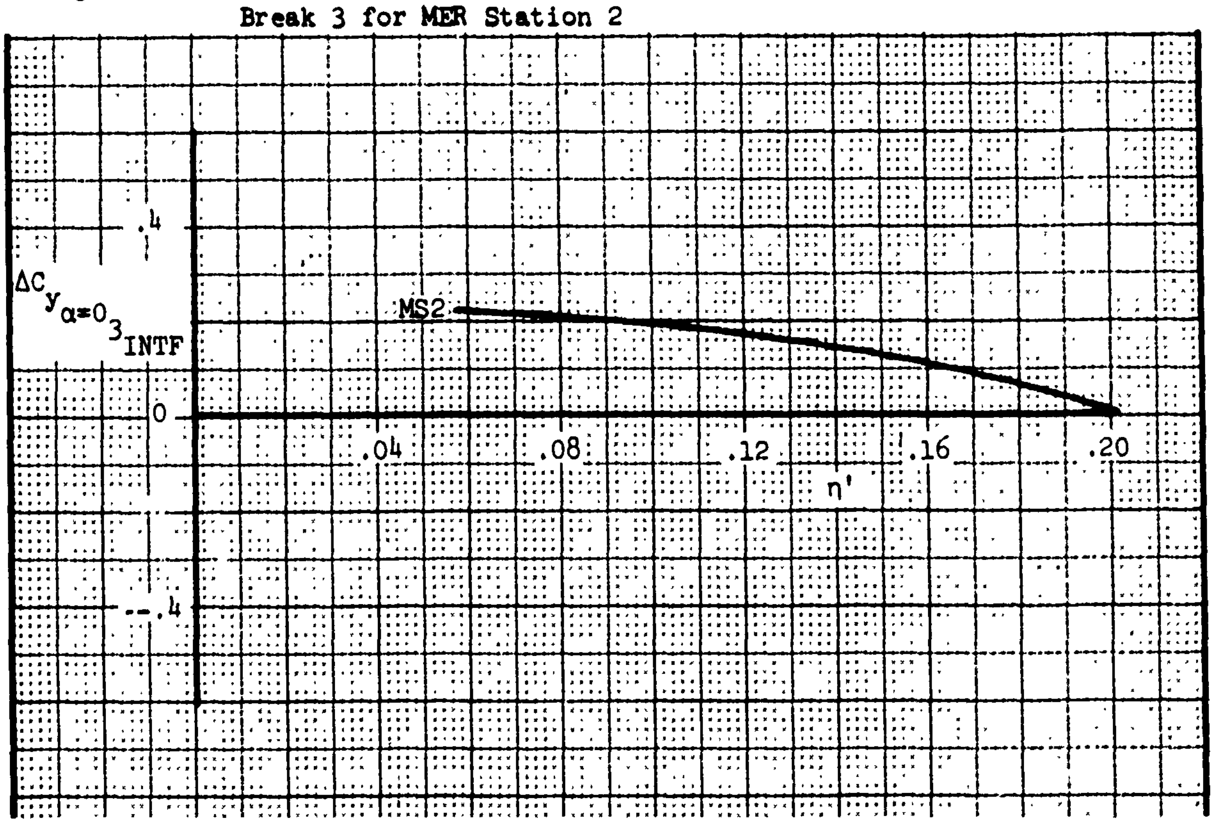



Figure 371. Side Force Intercept - Fuselage Interference Correction at Mach Break 3 for MER Station 2

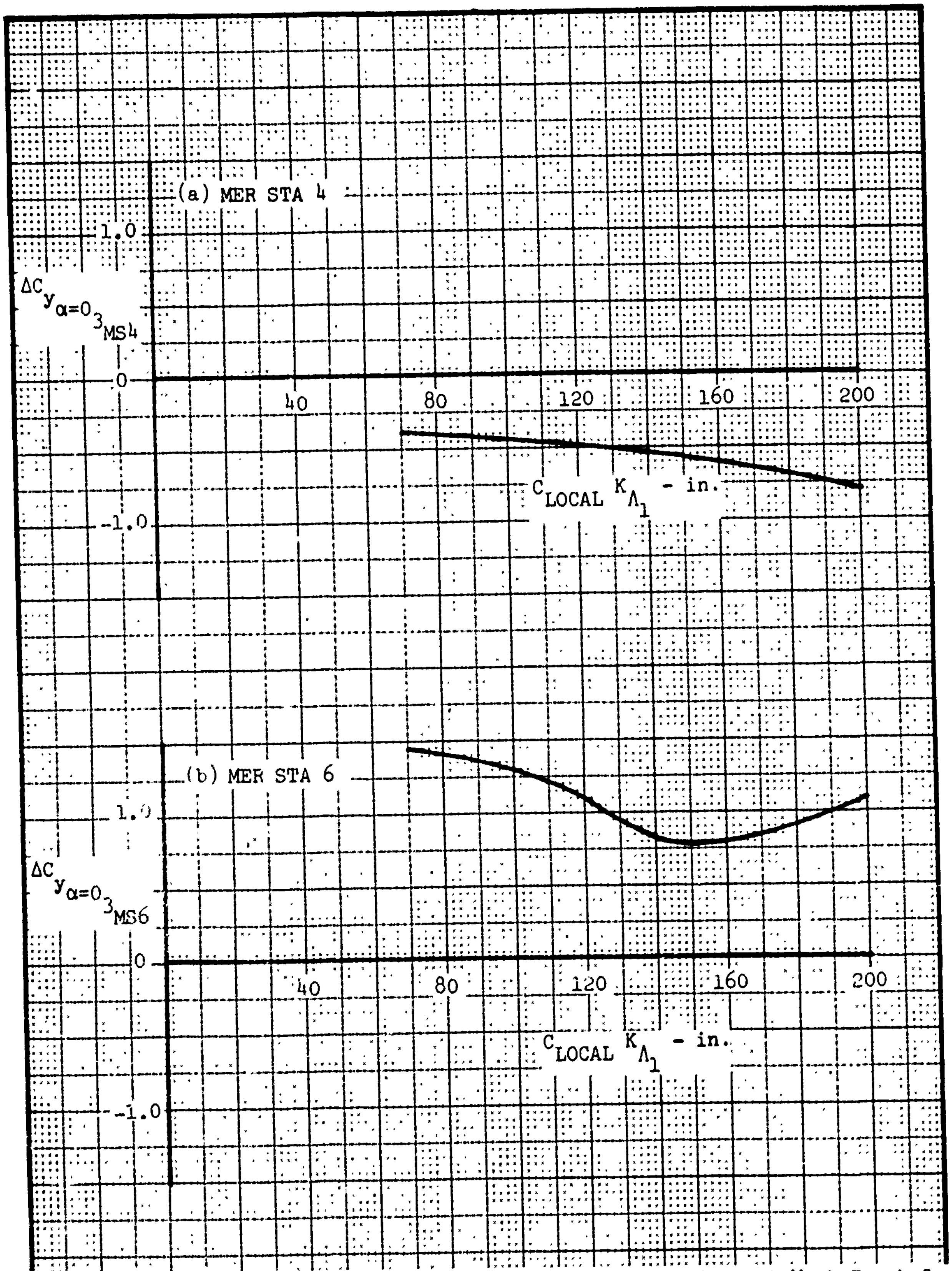



Figure 372. Side Force Intercept - Incremental Coefficient at Mach Break 3 for MER Stations 4 and 6

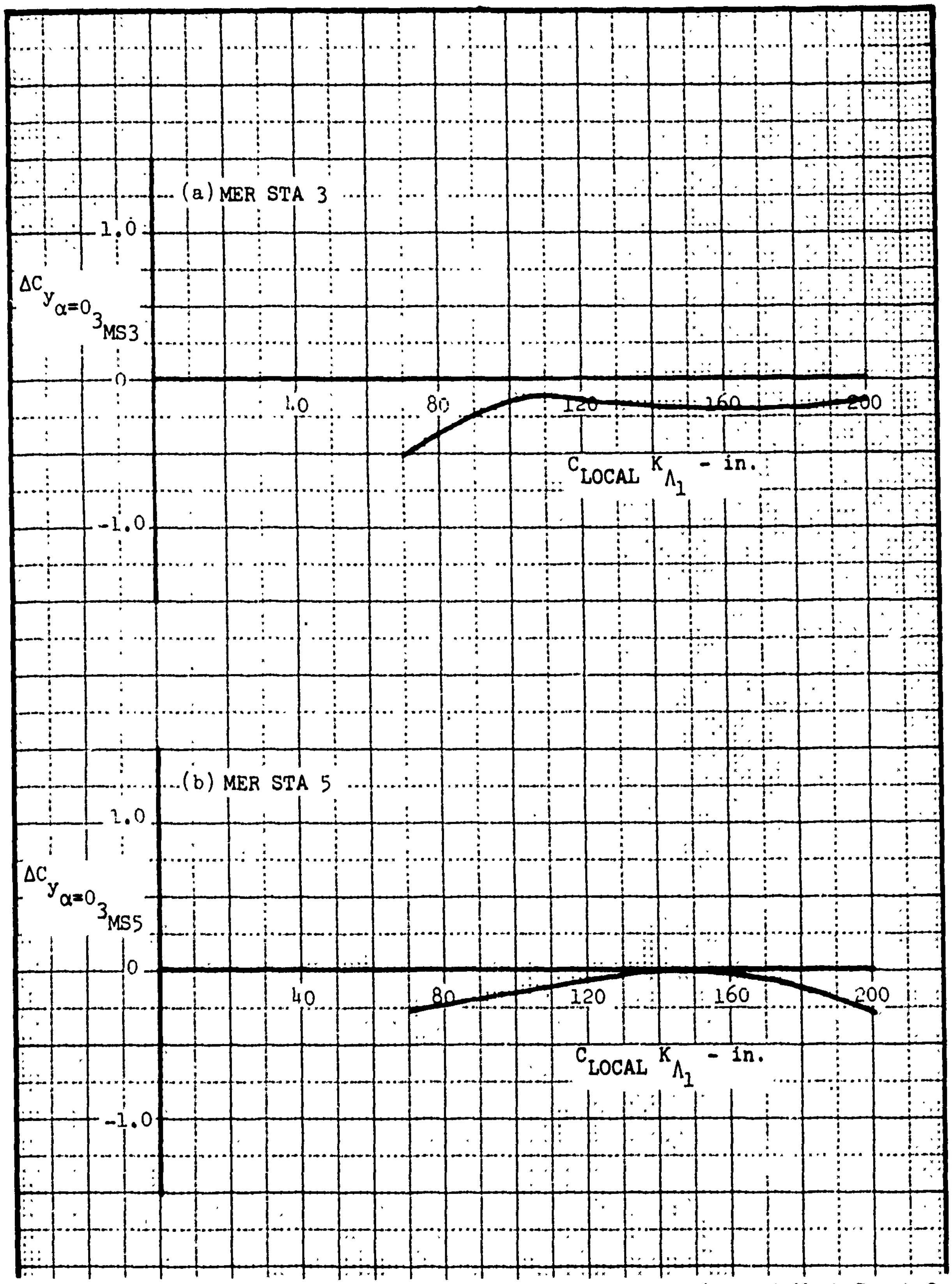



Figure 373. Side Force Intercept - Incremental Coefficient at Mach Break 3 for MER Stations 3 and 5

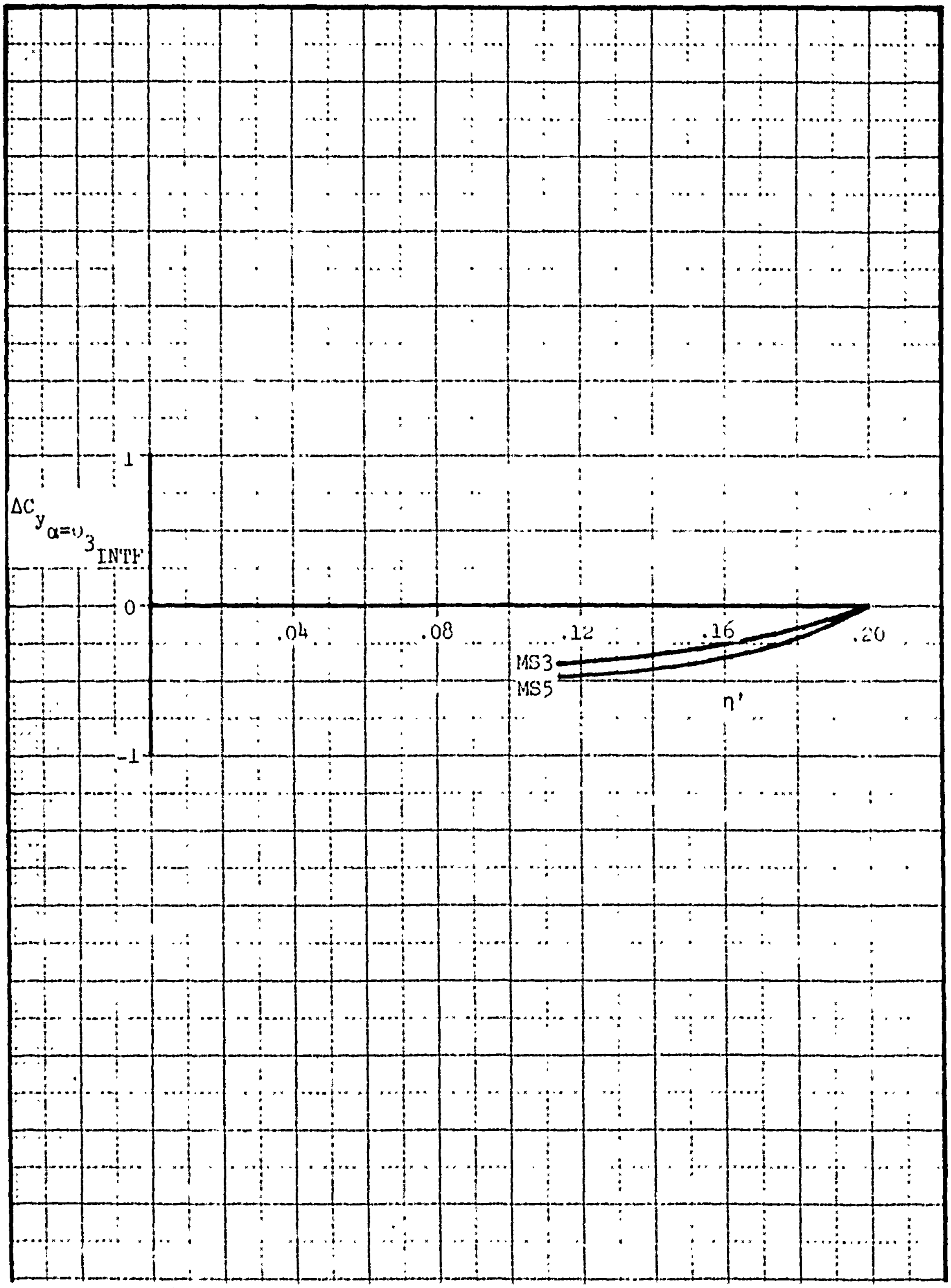



Figure 374. Side Force Intercept - Fuselage Interference Correction at Mach Break 3 for MER Stations 3 and 5

4.1.2 Increment - Aircraft Yaw

The captive store incremental side force due to aircraft yaw is obtained as the difference between the yawed pitch polar and the zero-yaw pitch polar data as outlined in Section III. The incremental side force slope, $\Delta\left(\frac{SF}{q}\right)_\alpha$, and intercept, $\Delta\left(\frac{SF}{q}\right)_{\alpha=0}$, thus obtained are linear with aircraft yaw angle; therefore, the incremental slope and intercept equations are derived and presented per degree of store yaw angle, $\beta$. The incremental airloads due to aircraft yaw are referenced to the coordinate system presented in Subsection 2.3.1.1.

To compute the incremental side force slope, $\Delta\left(\frac{SF}{q}\right)_\alpha$, the following equation is used.

$$\Delta\left(\frac{SF}{q}\right)_\alpha = \Delta\left(\frac{SF}{q}\right)_{\alpha_\beta} \cdot \beta$$

where:

$\Delta\left(\frac{SF}{q}\right)_{\alpha_\beta}$ - Incremental side force slope per degree $\beta$ as obtained by the methods presented in the following sections, $\frac{ft^2}{deg^2}$

$\beta$ - Store yaw angle, deg., equal to $+\psi_{A/C}$ for right wing store installation or $-\psi_{A/C}$ for left wing store installations.

The equation and procedure for computing the incremental side force intercept, $\Delta\left(\frac{SF}{q}\right)_{\alpha=0}$, due to aircraft yaw is similar to the above presentation for incremental side force slope.

4.1.2.1 <u>Slope Prediction</u>

The incremental side force slope prediction is divided into two sections, fuselage centerline-mounted stores and wing-mounted stores. The technique presented in this section covers the Mach number range 0.5 to 1.6.

FUSELAGE CENTERLINE-MOUNTED STORES

MER STATIONS 1-6 (MS1-6):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_{\beta_{\mathfrak{L}}}} = \Delta C_{y_{\alpha_{\beta_{\mathfrak{L}}}}}{}_{MS1-6} K_{SCALE_{SF}}$$

where:

$\Delta C_{y_{\alpha_{\beta_{\mathfrak{L}}}}}$ - Variation of $C_{y_{\alpha_\beta}}$ presented as a function of Mach number, $\frac{1}{deg^2}$, Figures 375 and 376.

$K_{SCALE_{NF}}$ - Defined in Section lV, $ft^2$.

WING-MOUNTED STORES

MER STATIONS 1, 3, and 5 (MS1,3,5):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_{\beta_{MS1,3,5}}} = \left(\Delta C_{y_{\alpha_{\beta_{MS1,3,5}}}} + K_{\frac{\ell_{LE_A}}{C}} \Delta C_{y_{\alpha_{\beta_{\frac{\ell_{LE_A}}{C}}}}}\right) K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha_\beta}}$ - Incremental $C_{y_\alpha}$ per degree $\beta$ presented as a function of wing spanwise position for Mach numbers 0.7, 0.9, 1.05, 1.2, and 1.6, $\frac{1}{deg^2}$, Table 7.

$K_{\frac{\ell_{LE_A}}{C}}$ - Proportioning factor based on the distance from the wing leading edge to the nose of the store on MER STATION 1 measured in the wing plan view divided by the local wing chord, positive, Figure 388.

$\Delta C_{y_{\alpha_{\beta_{\ell_{LE_A}/C}}}}$ - Incremental $C_{y_\alpha}$ per degree $\beta$ based on $\ell_{LE_A}/C$ defined above and presented as a function of Mach number, $\frac{1}{deg^2}$

MER STA 1 - Figure 387

MER STA 3 - Figure 387

MER STA 5 - Figure 387

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Wing sweep correction factor, $\frac{\sin \Lambda}{\sin 45°}$, where $\Lambda$ is the quarter chord sweep of the aircraft wing.

MER STATIONS 2, 4, and 6 (MS2,3,6):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_{\beta_{MS2,4,6}}} = \Delta C_{y_{\alpha_{\beta_{MS2,4,6}}}} K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha_\beta}}$ - Incremental $C_{y_\alpha}$ per degree $\beta$ presented as a function of wing spanwise position for Mach numbers 0.7, 0.9, 1.05, 1.2, and 1.6, $\frac{1}{deg^2}$, Table 7.

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Defined in MS1, 3,5 above.

The variation of $\Delta C_{y_{\alpha_\beta}}$ for MER STATIONS 1-6 is presented at distinct Mach numbers of 0.7, 0.9, 1.05, 1.2, and 1.6. Table 7

presented below is a guide for locating the curves for $\Delta C_{y_{\alpha_\beta}}$ for each MER STATION at the Mach numbers indicated above. For Mach numbers between 0.5 and 0.7, the value at M = 0.7 should be used in the computation. For Mach numbers between 0.7 and 1.6 other than those distinctly presented, linear interpolation should be used between the appropriate Mach numbers to obtain the required value for computation.

TABLE 7. INCREMENTAL SIDE FORCE SLOPE COEFFICIENT DUE TO YAW - FIGURE LOCATION GUIDE

| $\Delta C_{y_{\alpha_\beta}}$ | MACH NUMBER | | | | |
|---|---|---|---|---|---|
| | 0.7 | 0.9 | 1.05 | 1.2 | 1.6 |
| | Figure Numbers | | | | |
| MER STA 1 | 377 | 379 | 381 | 383 | 385 |
| MER STA 2 | 378 | 380 | 382 | 384 | 386 |
| MER STA 3 | 377 | 379 | 381 | 383 | 385 |
| MER STA 4 | 378 | 380 | 382 | 384 | 386 |
| MER STA 5 | 377 | 379 | 381 | 383 | 385 |
| MER STA 6 | 378 | 380 | 382 | 384 | 386 |

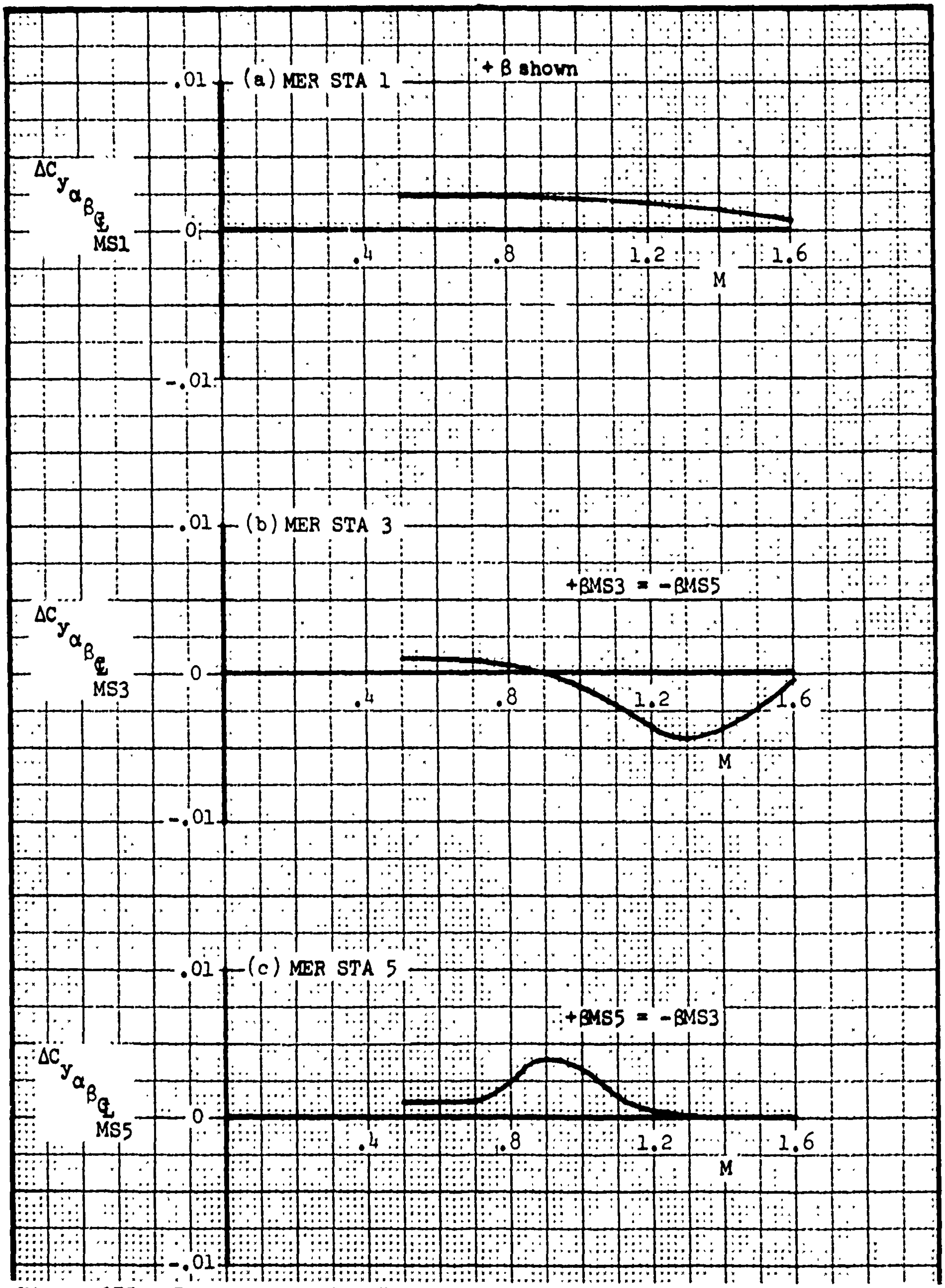



Figure 375. Incremental Side Force Slope Due to Yaw - Coefficient for Stores Mounted on Fuselage Centerline, MER Stations 1, 3, and 5

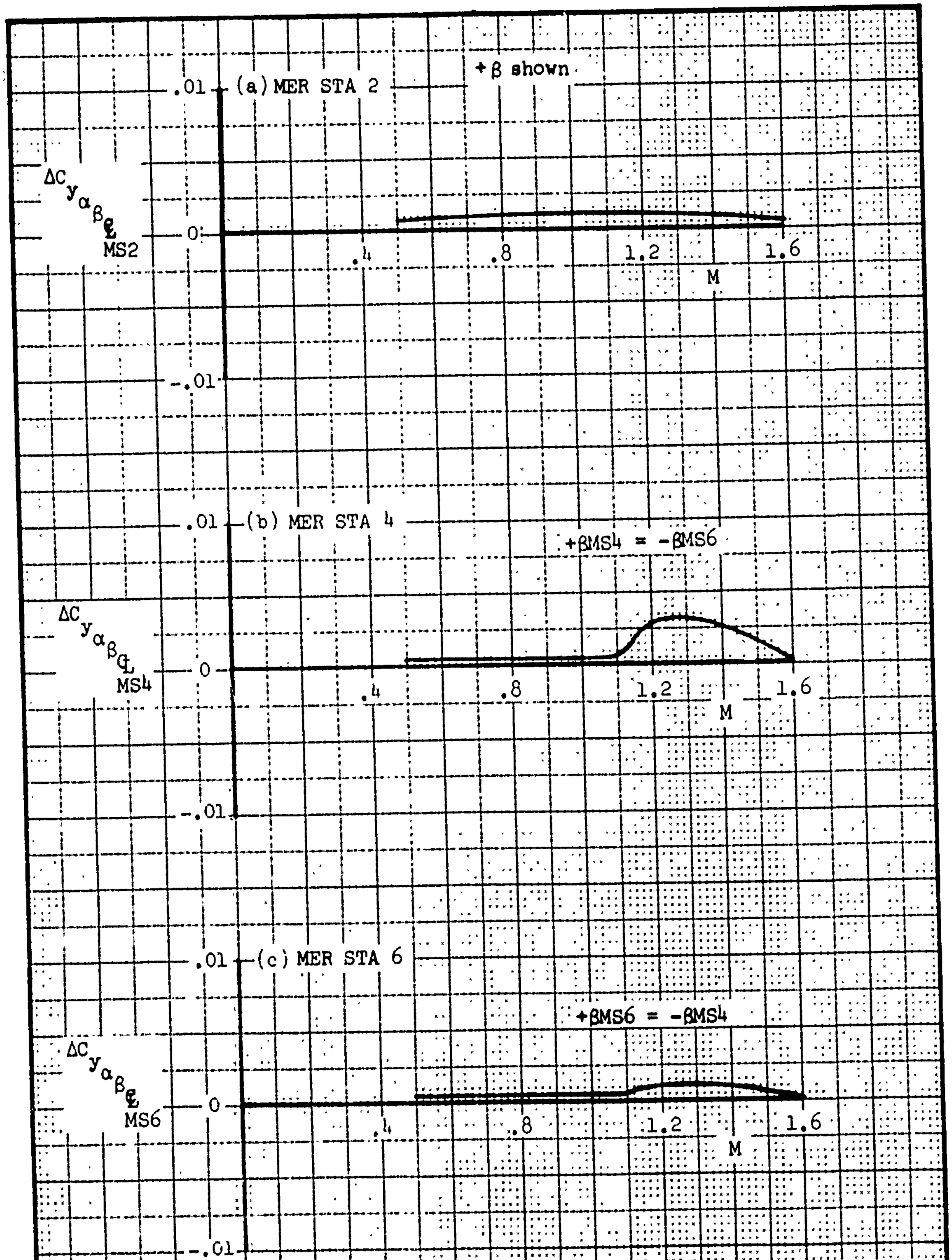



Figure 376. Incremental Side Force Slope Due to Yaw - Coefficient for Stores Mounted on Fuselage Centerline, MER Stations 2,4 and 6

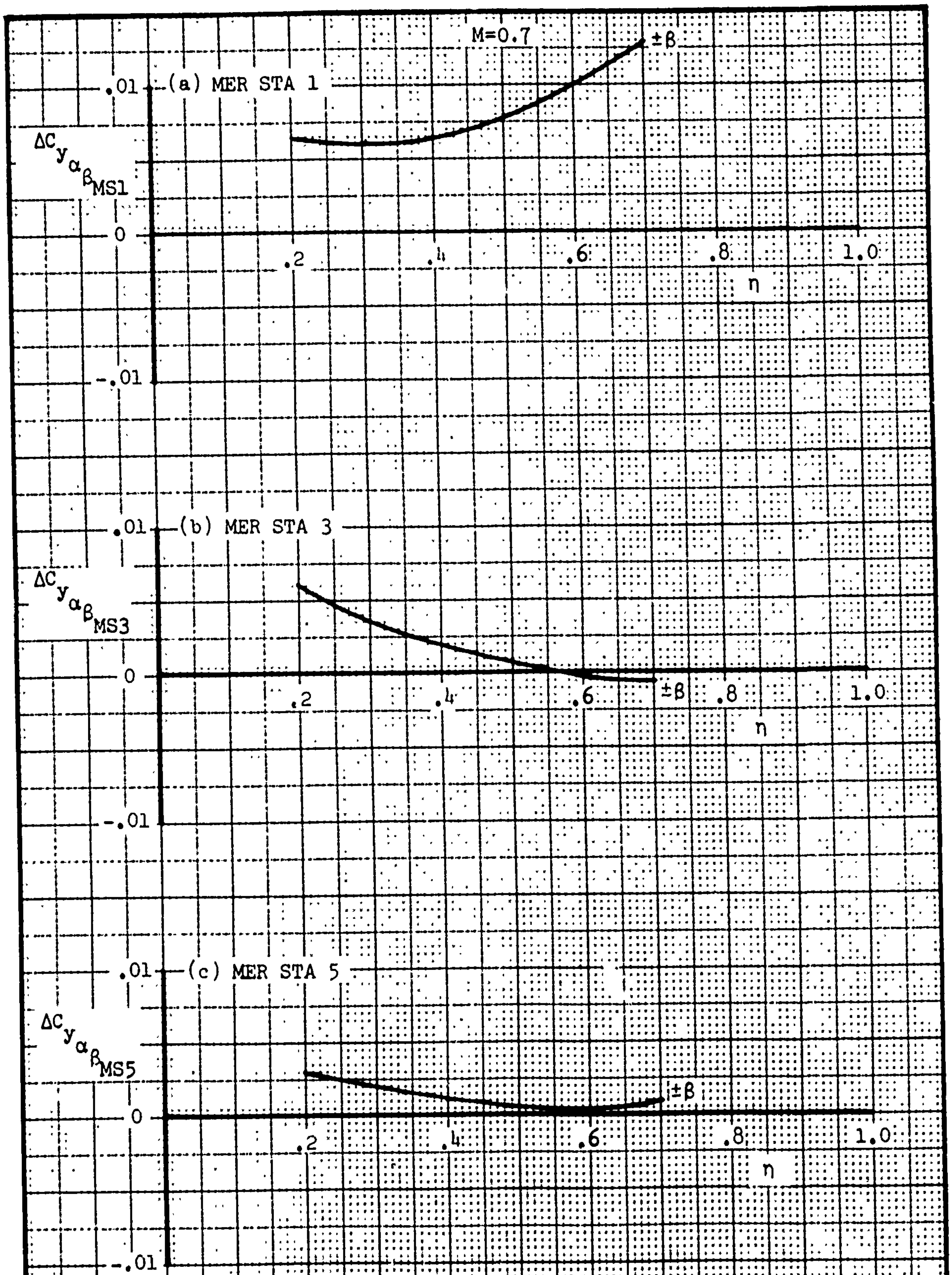



Figure 377. Incremental Side Force Slope Due to Yaw - Spanwise Correction at M=0.7 for MER Stations 1, 3 and 5

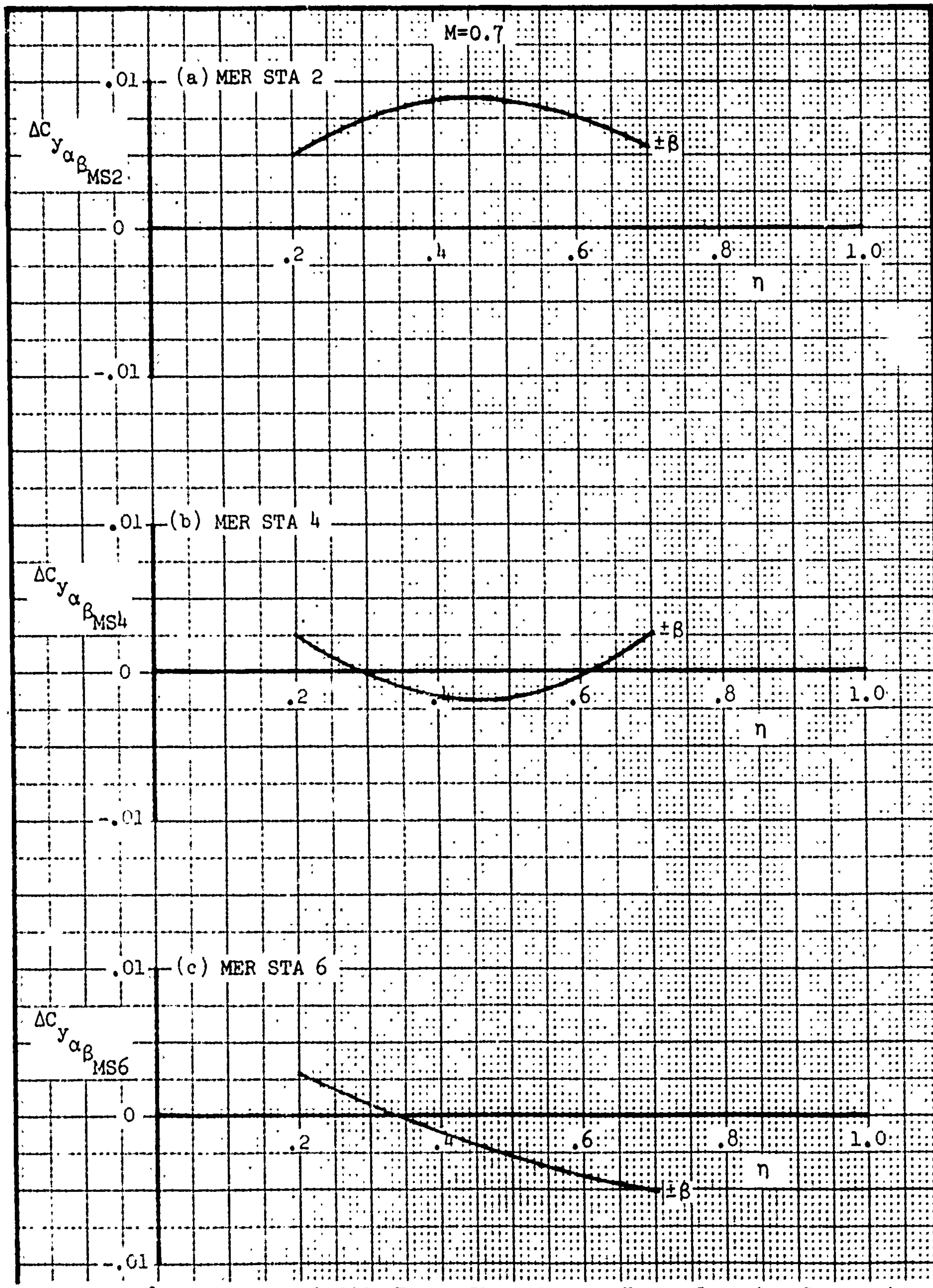



Figure 378. Incremental Side Force Slope Due to Yaw - Spanwise Correction at M=0.7 for MER Stations 2, 4 and 6

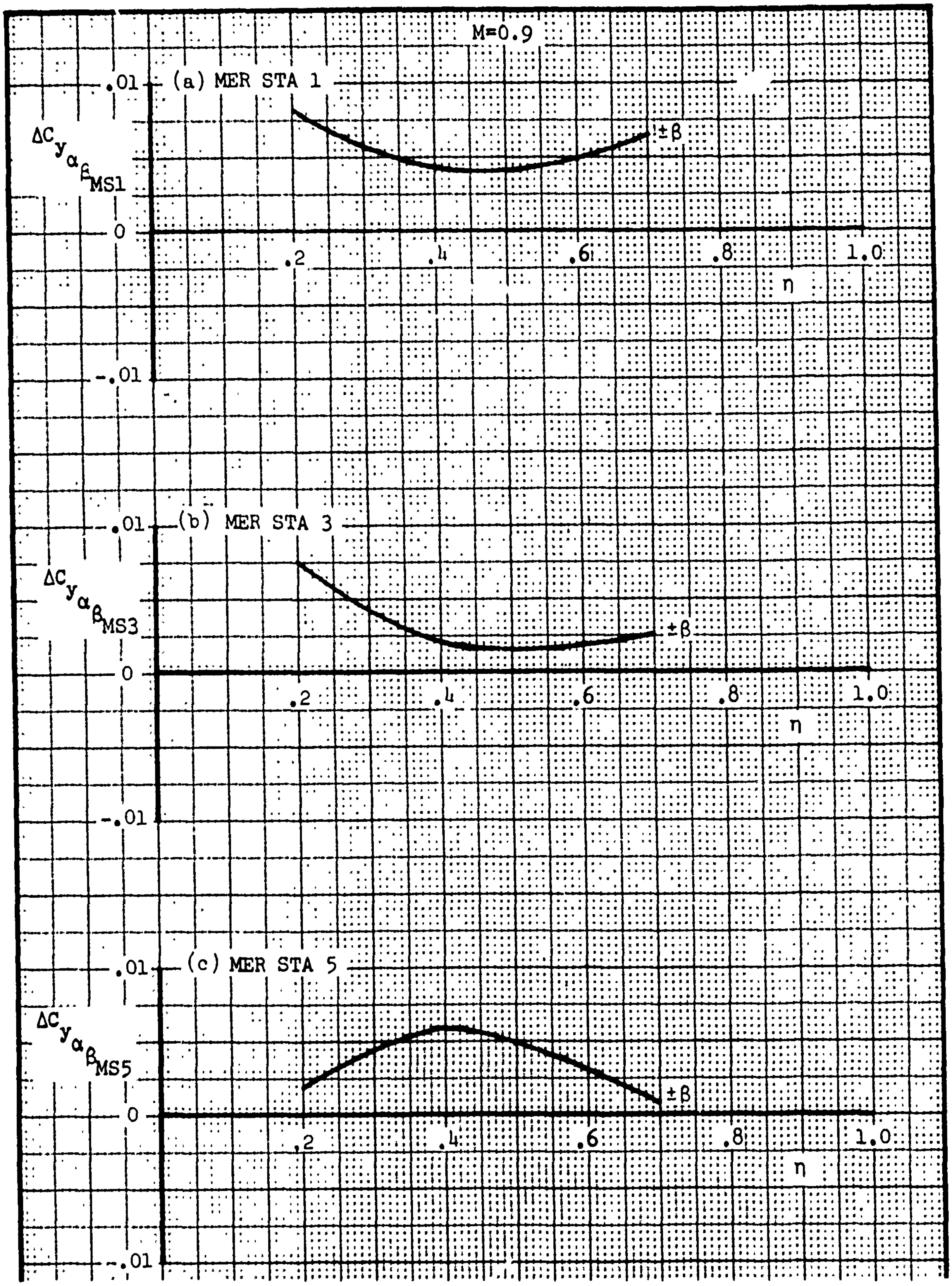



Figure 379. Incremental Side Force Slope Due to Yaw - Spanwise Correction at M=0.9 for MER Stations 1,3, and 5

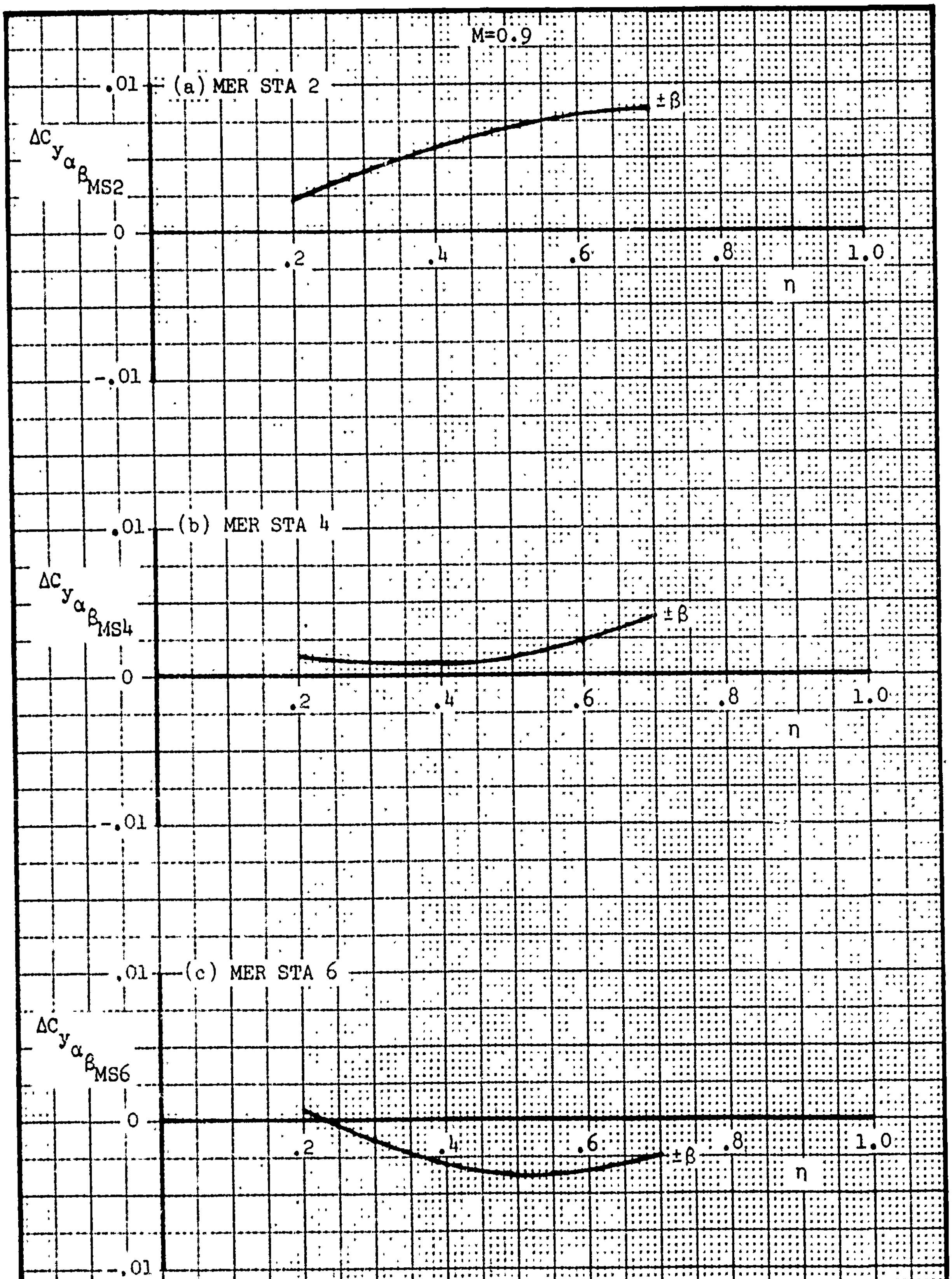



Figure 380. Incremental Side Force Slope Due to Yaw - Spanwise Correction at M=0.9 for MER Stations 2,4, and 6

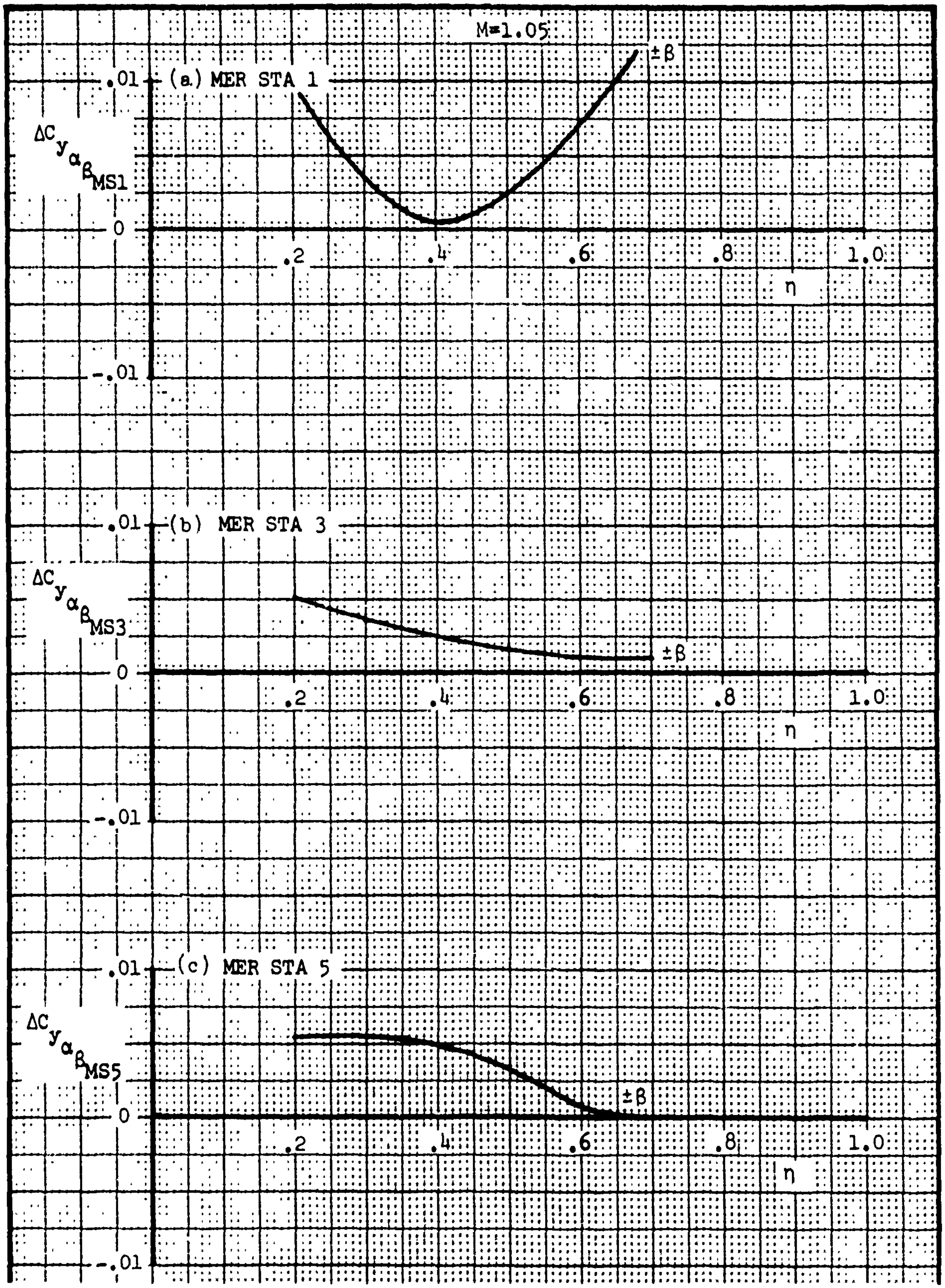



Figure 381. Incremental Side Force Slope Due to Yaw - Spanwise Correction at M=1.05 for MER Stations 1,3, and 5

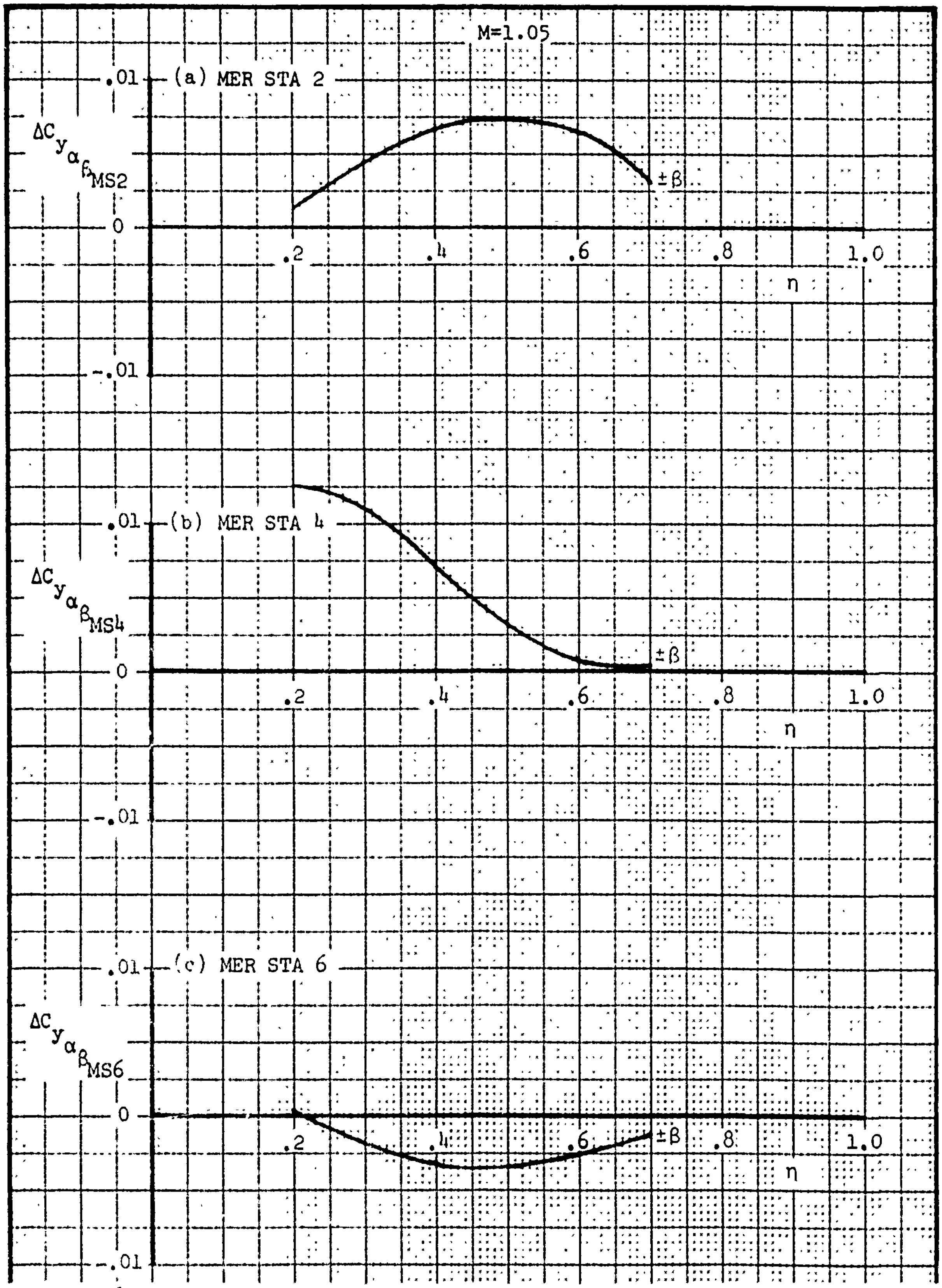



Figure 382. Incremental Side Force Slope Due to Yaw - Spanwise Correction at M=1.05 for MER Stations 2,4, and 6

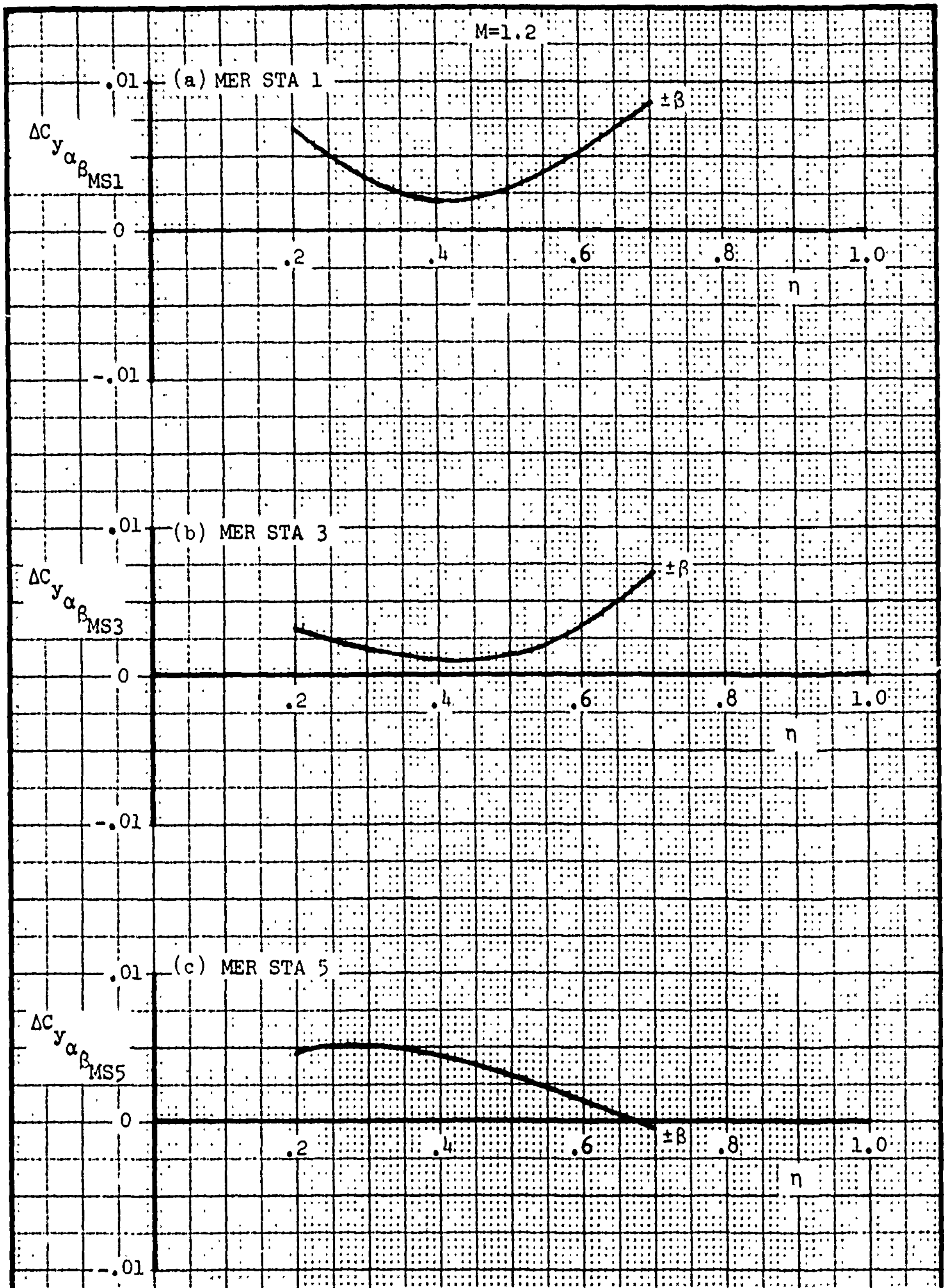



Figure 383. Incremental Side Force Slope Due to Yaw - Spanwise Correction at M=1.2 for MER Stations 1,3, and 5

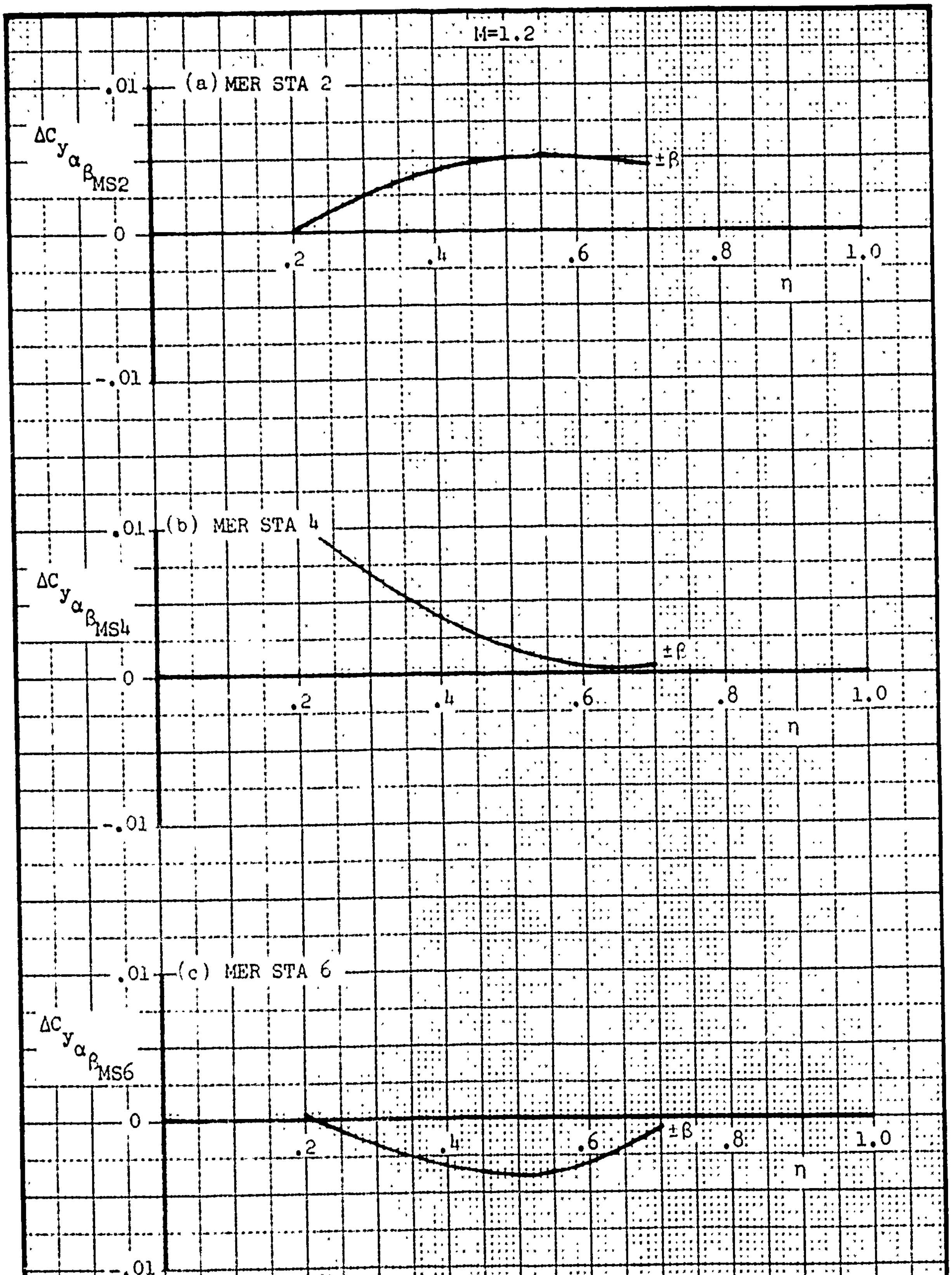


Figure 384. Incremental Side Force Slope Due to Yaw - Spanwise Correction at M=1.2 for MER Stations 2,4, and 6

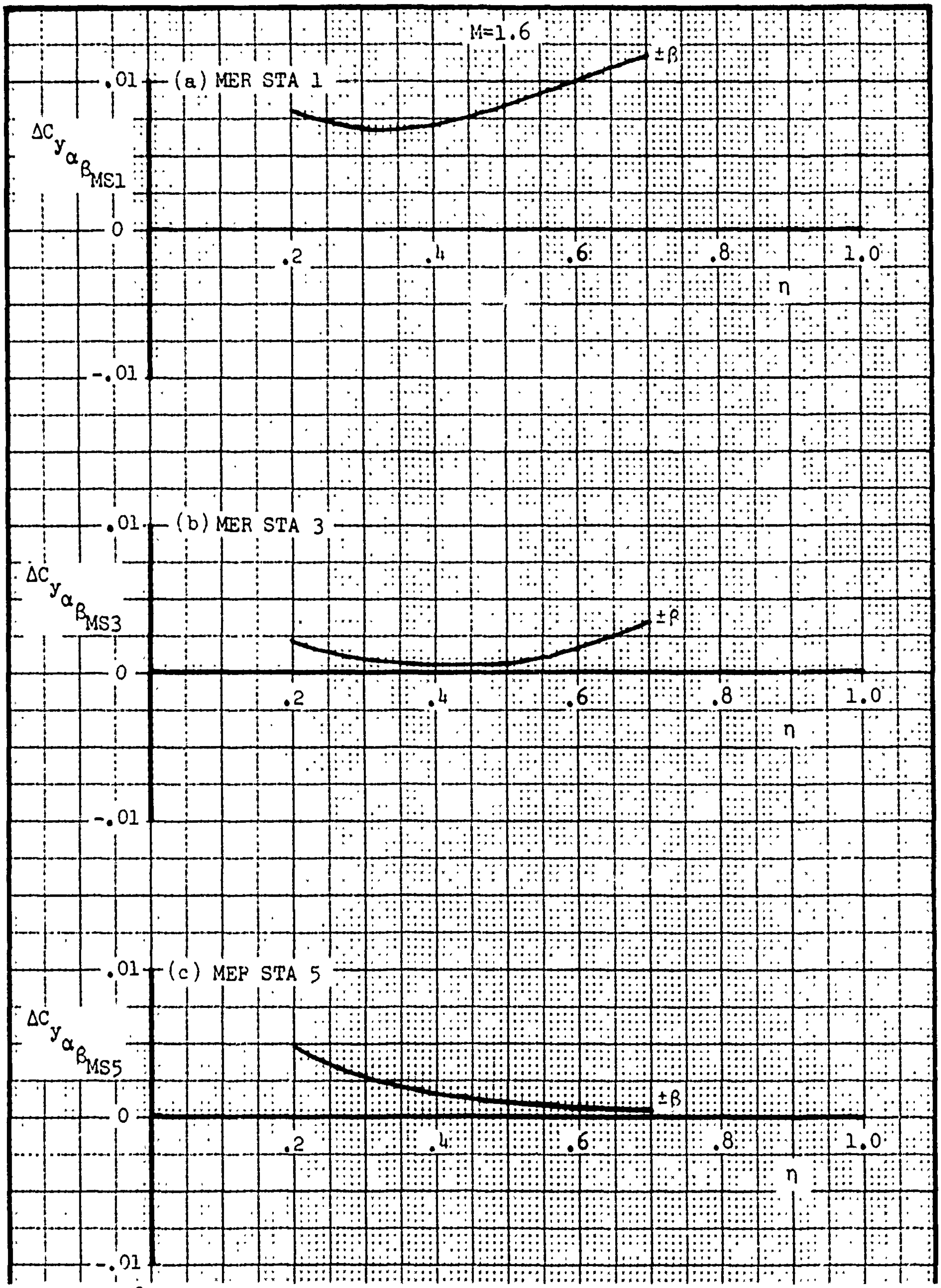



Figure 385. Incremental Side Force Slope Due to Yaw - Spanwise Correction at M=1.6 for MER Stations 1,3, and 5

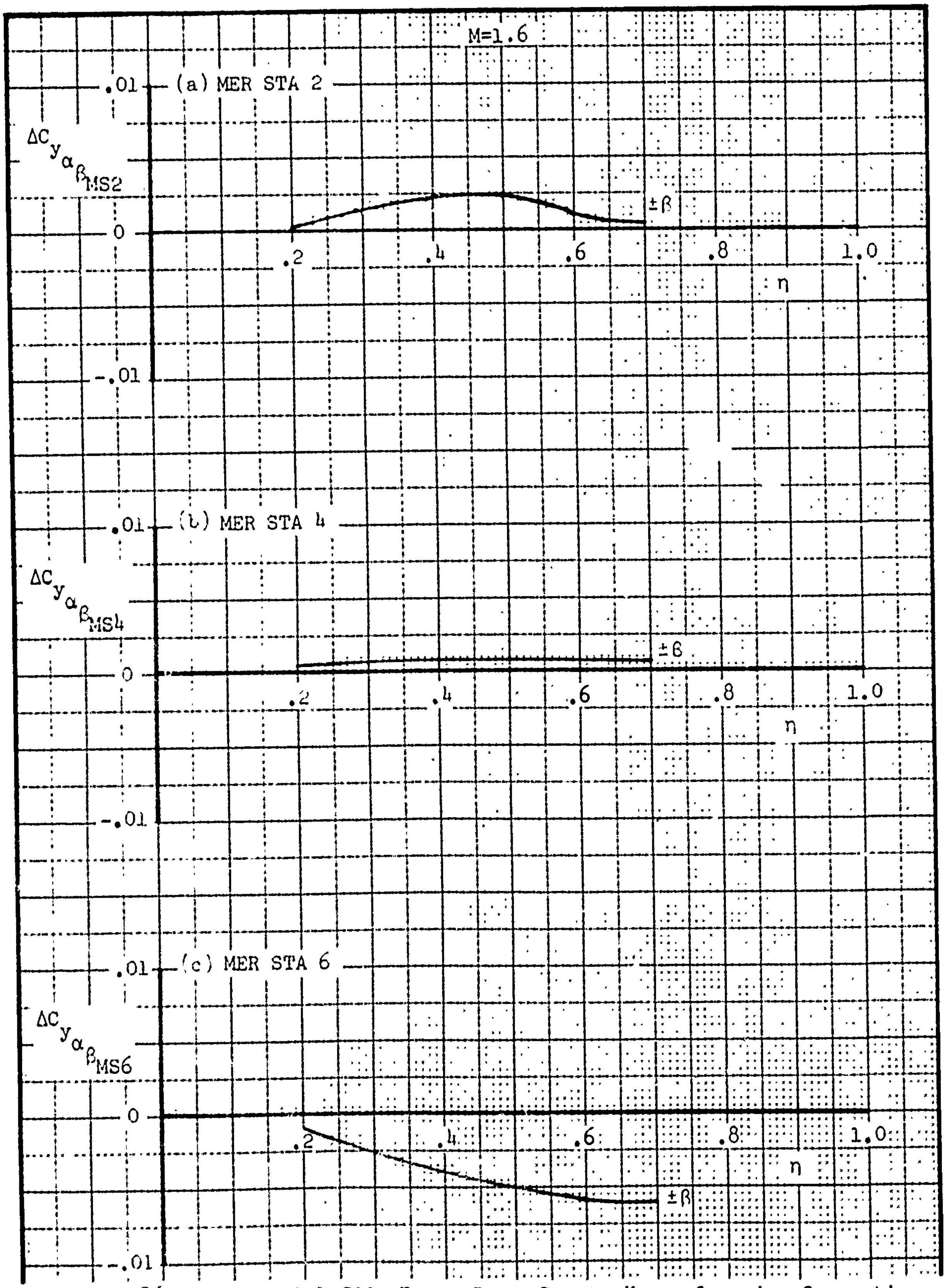



Figure 386. Incremental Side Force Slope Due to Yaw - Spanwise Correction at M=1.6 for MER Stations 2,4, and 6

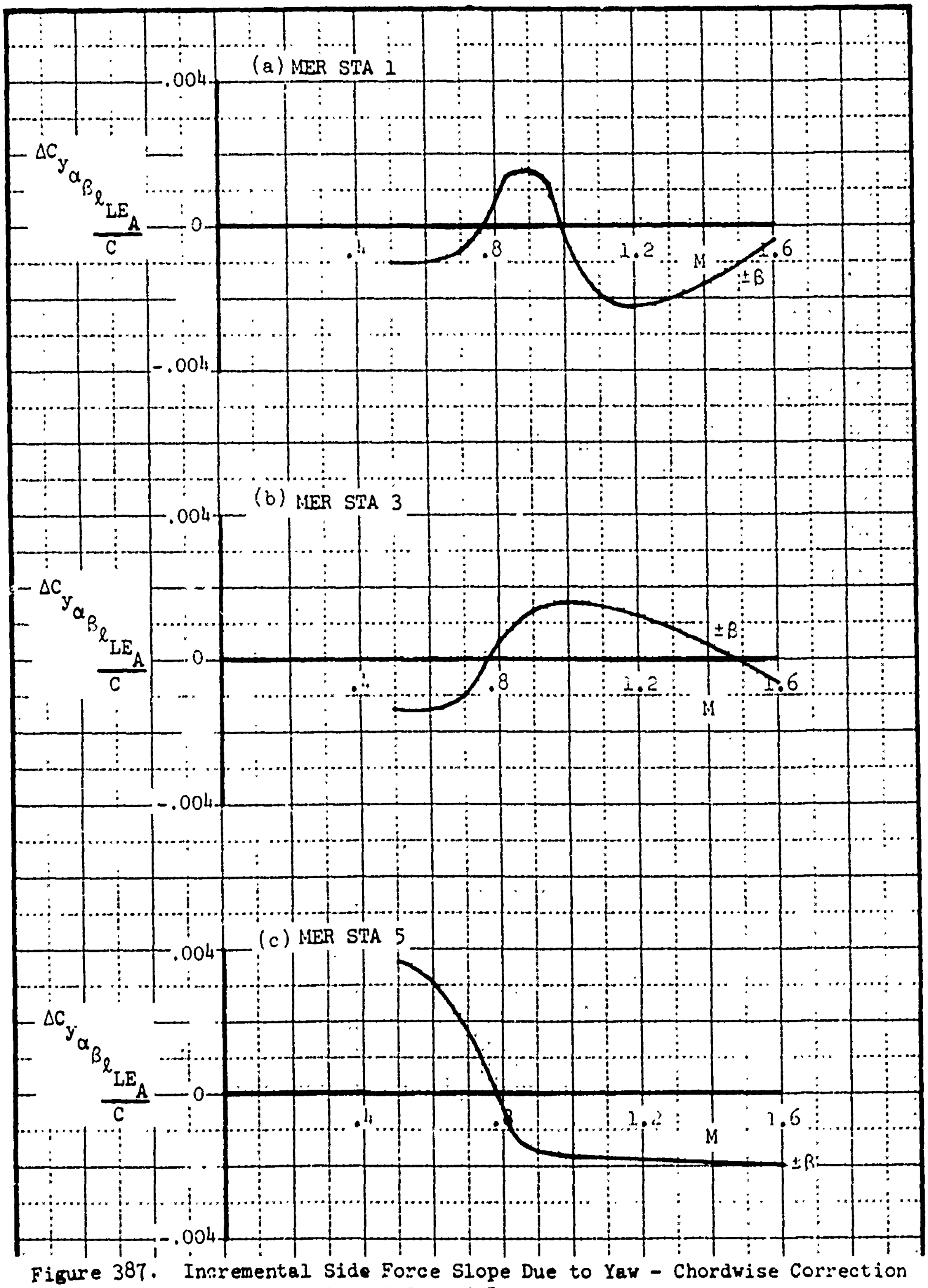



Figure 387. Incremental Side Force Slope Due to Yaw - Chordwise Correction for MER Stations 1,3, and 5

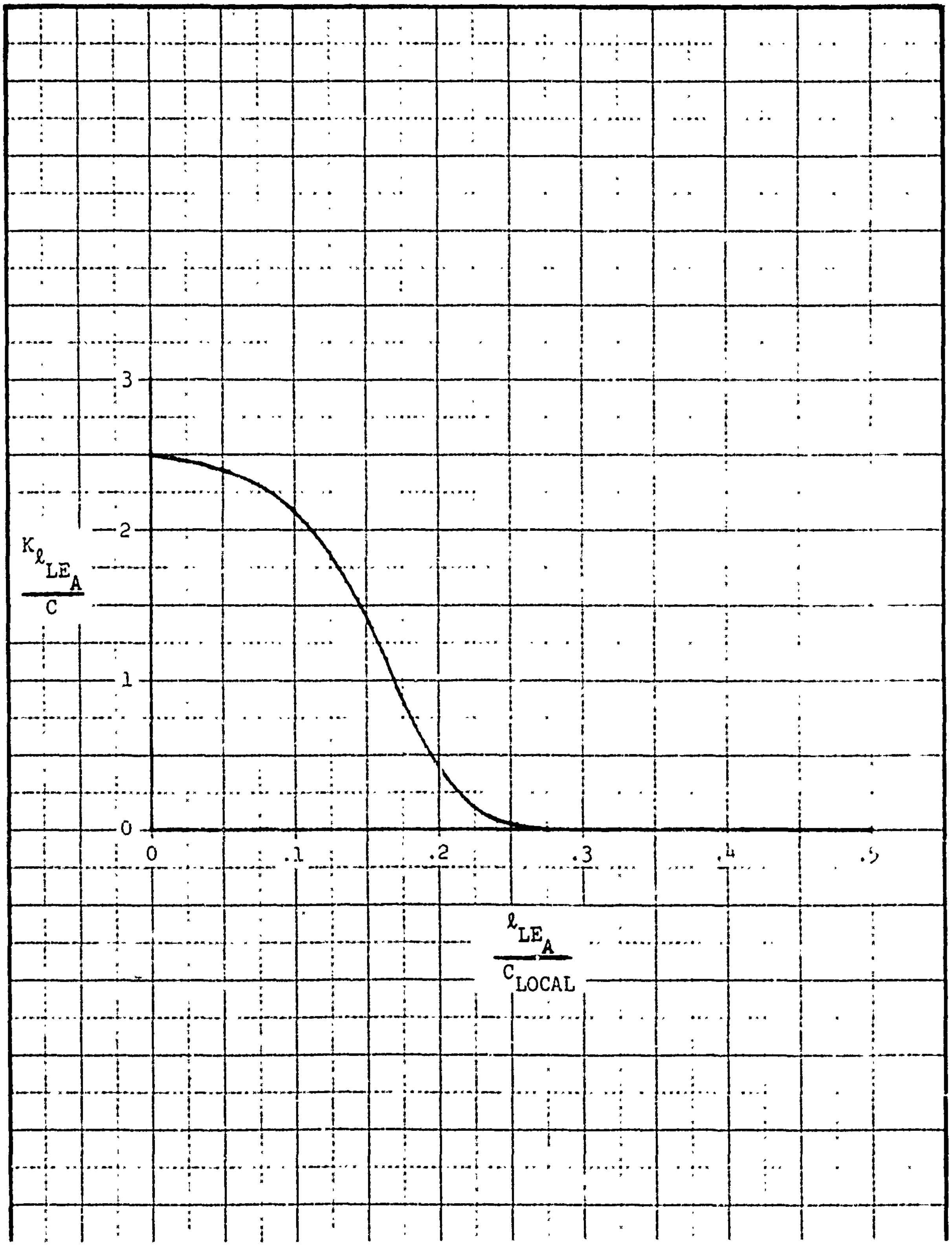



Figure 388. Incremental Side Force Slope Due to Yaw - Chordwise Correction Factor

4.1.2.2 Intercept Prediction

The incremental side force intercept prediction is divided into two sections, fuselage centerline-mounted stores and wing-mounted stores. The technique presented in this section covers the Mach number range 0.5 to 1.6.

FUSELAGE CENTERLINE-MOUNTED STORES

MER STATIONS 1-6 (MS1-6):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha=0_{\beta_{\mathbb{C}}}} = \Delta C_{y_{\alpha=0_{\beta_{\mathbb{C}}}}}{}_{MS1-6} \; K_{SCALE_{SF}}$$

where:

$\Delta C_{y_{\alpha=0_{\beta_{\mathbb{C}}}}}$ - Variation of $C_{y_{\alpha=0_{\beta}}}$ presented as a function of Mach number, $\frac{1}{\text{deg.}}$

MER STA 1 - Figure 389

MER STA 2 - Figure 390

MER STA 3 - Figure 389

MER STA 4 - Figure 390

MER STA 5 - Figure 389

MER STA 6 - Figure 390

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

WING-MOUNTED STORES

MER STATIONS 1, 3 and 5 (MS1,3,5):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha=0_{\beta_{MS1,3,5}}} = \left(\Delta C_{y_{\alpha=0_{\beta_{MS1,3,5}}}} + K_{\frac{\ell_{LE_A}}{C}} \Delta C_{y_{\alpha=0_{\beta_{\frac{\ell_{LE_A}}{C}}}}}\right) K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha=0_\beta}}$ - Incremental $C_{y_{\alpha=0}}$ per degree β presented as a function of wing spanwise position for Mach numbers 0.7, 0.9, 1.05, 1.2, and 1.6, $\frac{1}{deg}$, Table 8.

$K_{\frac{\ell_{LE_A}}{C}}$ - Proportioning factor based on the distance from the wing leading edge to the nose of the store on MER STATION 1 measured in the wing plan view divided by the local wing chord, positive, Figure 388, Subsection 4.1.2.1.

$\Delta C_{y_{\alpha=0_{\beta_{\frac{\ell_{LE_A}}{C}}}}}$ - Incremental $C_{y_{\alpha=0}}$ per degree β based on $\ell_{LE_A}/C$ defined above and presented as a function of Mach number, $\frac{1}{deg}$

MER STA 1 - Figure 401

MER STA 3 - Figure 401

MER STA 5 - Figure 401

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Wing sweep correction factor, $\frac{\sin \Lambda}{\sin 45°}$, where Λ is the quarter chord sweep of the aircraft wing.

MER STATIONS 2, 4, and 6 (MS2,4,6):

$$\Delta\left(\frac{SF}{q}\right)_{\alpha=0_{\beta}\,MS2,4,6} = \Delta C_{y_{\alpha=0_{\beta}}\,MS2,4,6} K_{SCALE_{SF}} K_{\Lambda_1}$$

where:

$\Delta C_{y_{\alpha=0_{\beta}}}$ - Incremental $C_{y_{\alpha=0}}$ per degree β presented as a function of wing spanwise position for Mach numbers 0.7, 0.9, 1.05, 1.2, and 1.6, $\frac{1}{deg}$, Table 8.

$K_{SCALE_{SF}}$ - Defined in Section IV, $ft^2$.

$K_{\Lambda_1}$ - Defined in MS1, 3, 5 above.

The variation of $\Delta C_{y_{\alpha=0_{\beta}}}$ for MER STATIONS 1 to 6 is presented at distinct Mach numbers of 0.7, 0.9, 1.05, 1.2, and 1.6. Table 8 presented below is a guide for locating the curves for $\Delta C_{y_{\alpha=0_{\beta}}}$ for each MER station at the Mach numbers indicated above. For Mach numbers between 0.5 and 0.7, the value at M = 0.7 should be used in the computation. For Mach numbers between 0.7 and 1.6, other than those distinctly presented, linear interpolation should be used between the appropriate Mach numbers to obtain the required value for computation.

Table 8. INCREMENTAL SIDE FORCE INTERCEPT COEFFICIENT DUE TO YAW - FIGURE LOCATION GUIDE

| $\Delta C_{y_{\alpha=0_\beta}}$ | MACH NUMBER | | | | |
|---|---|---|---|---|---|
| | 0.7 | 0.9 | 1.05 | 1.2 | 1.6 |
| | Figure Numbers | | | | |
| MER STA 1 | 391 | 393 | 395 | 397 | 399 |
| MER STA 2 | 392 | 394 | 396 | 398 | 400 |
| MER STA 3 | 391 | 393 | 395 | 397 | 399 |
| MER STA 4 | 392 | 394 | 396 | 398 | 400 |
| MER STA 5 | 391 | 393 | 395 | 397 | 399 |
| MER STA 6 | 392 | 394 | 396 | 398 | 400 |

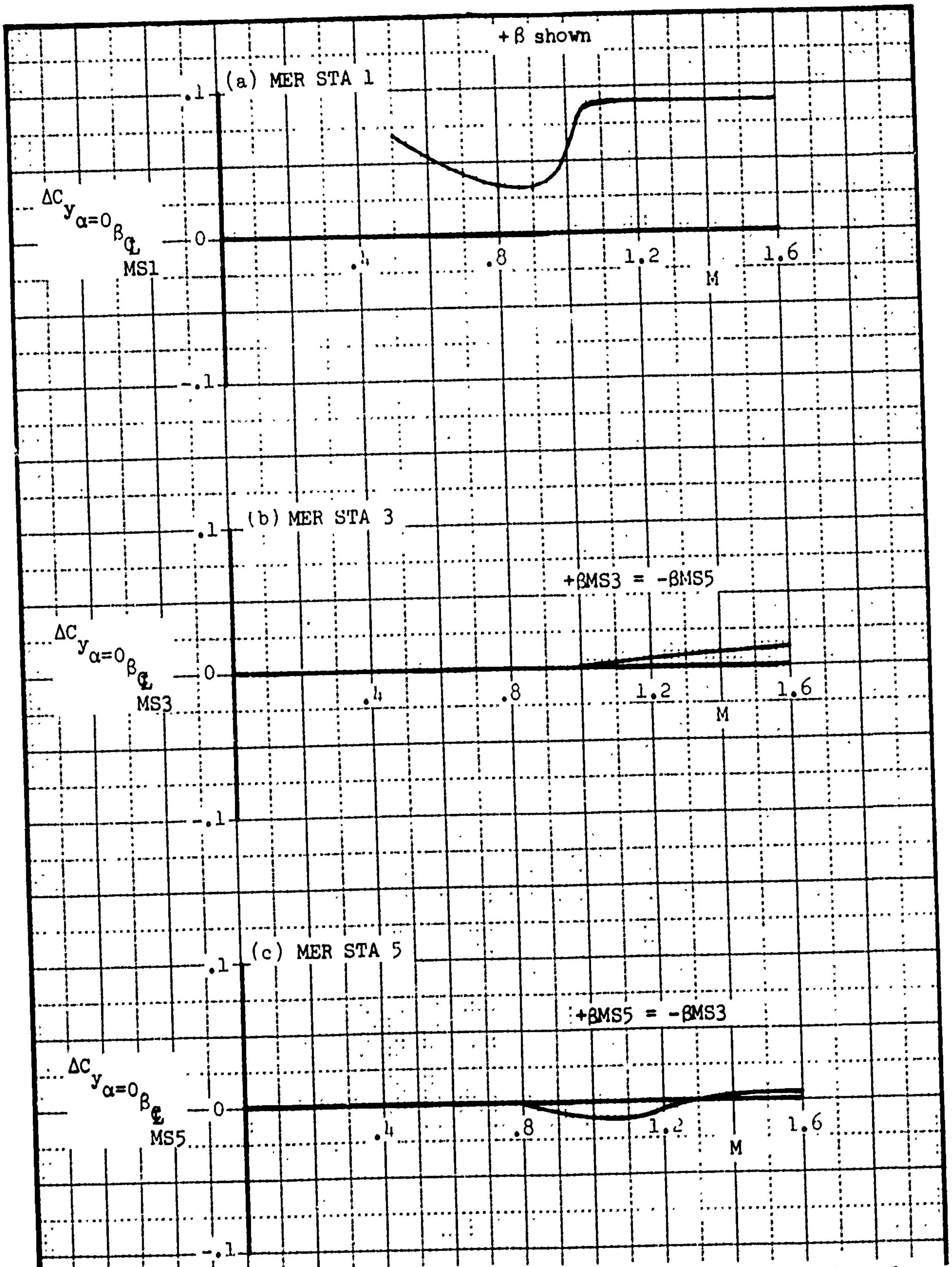



**Figure 389. Incremental Side Force Intercept Due to Yaw - Coefficient for Stores Mounted on Fuselage Centerline, MER Stations 1,3 and 5**

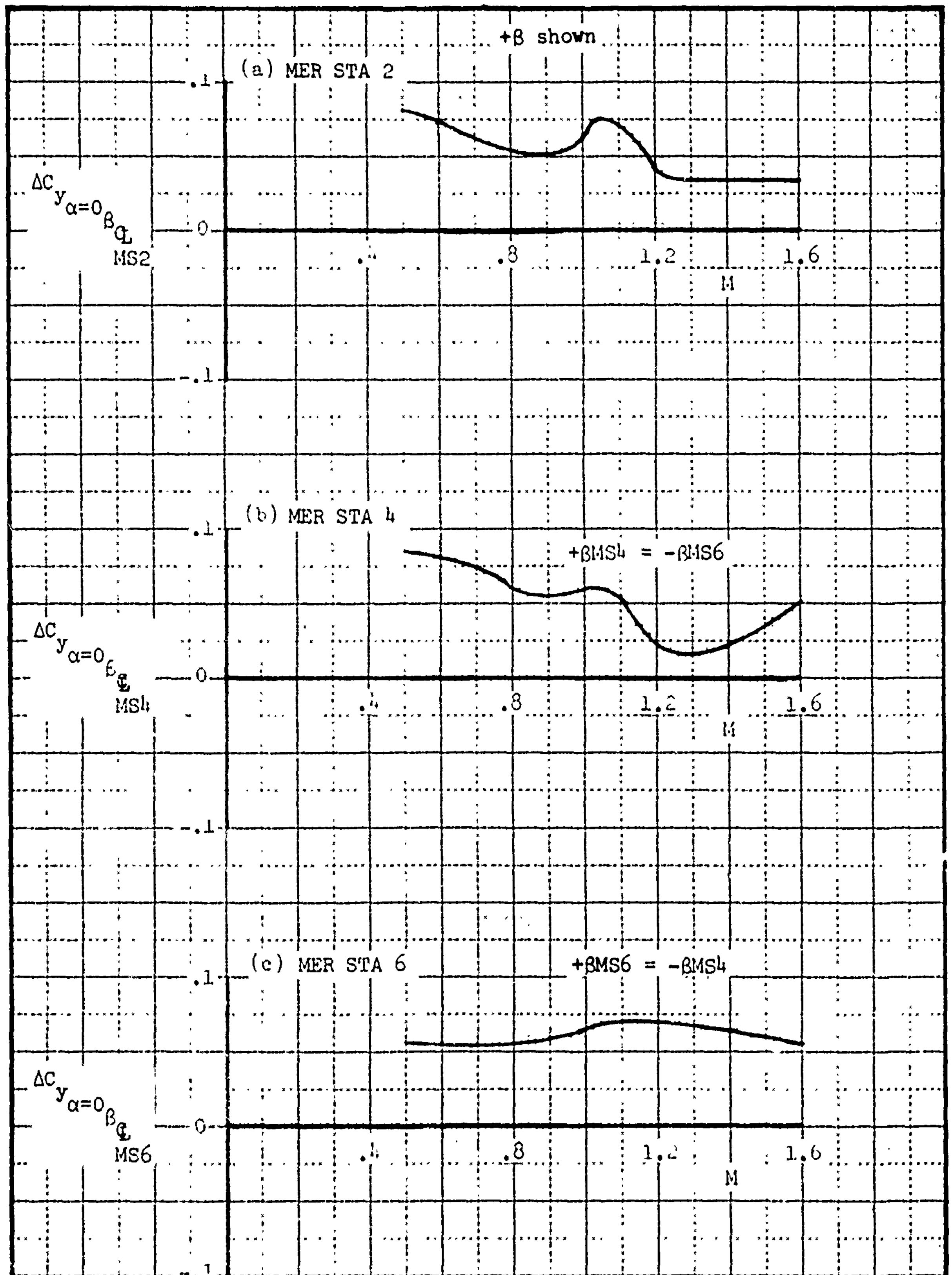



Figure 390. Incremental Side Force Intercept Due to Yaw - Coefficient for Stores Mounted on Fuselage Centerline, MER Stations 2,4, and 6

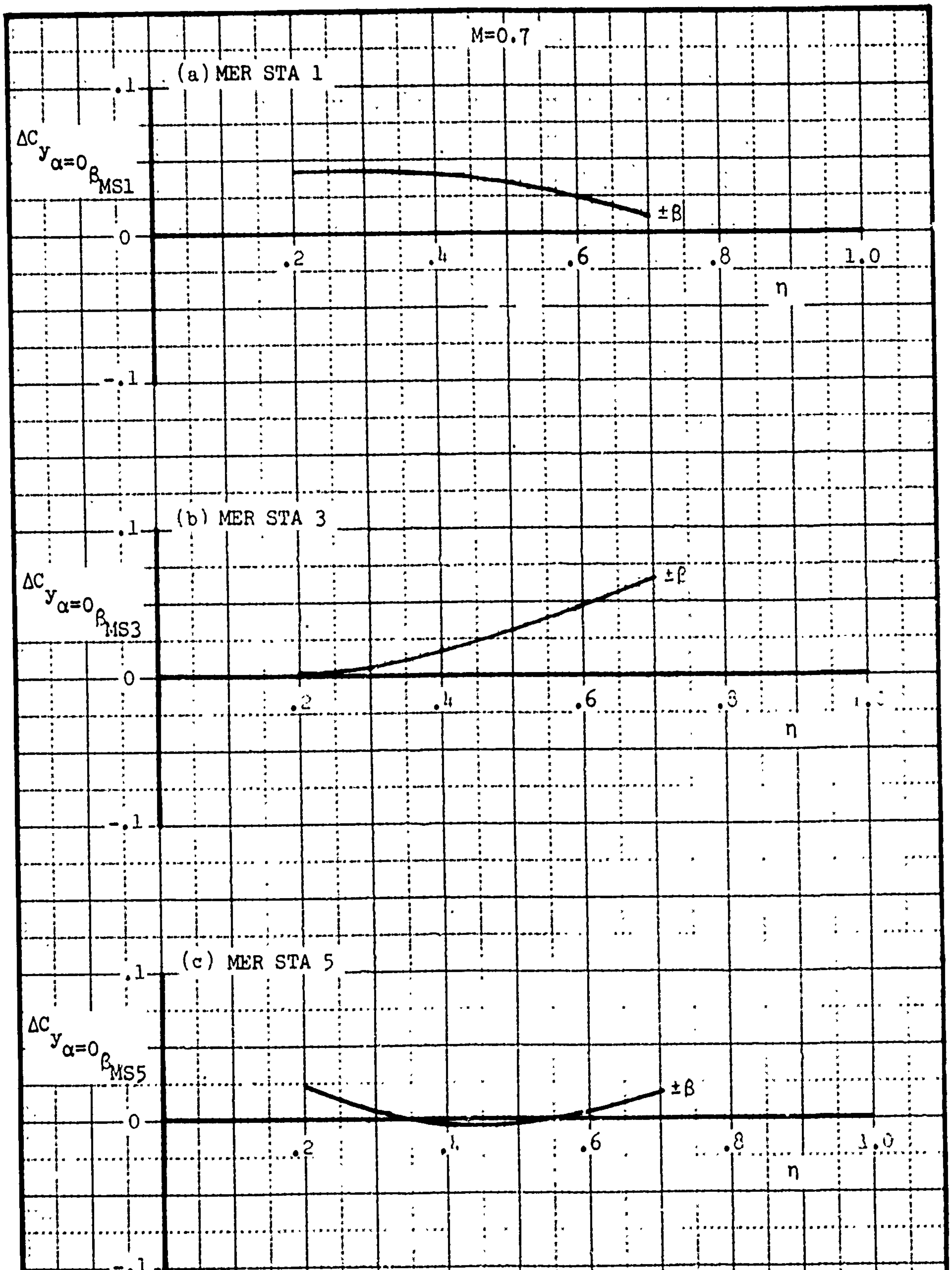



Figure 391. Incremental Side Force Intercept Due to Yaw - Spanwise Correction at M=0.7 for MER Stations 1,3, and 6

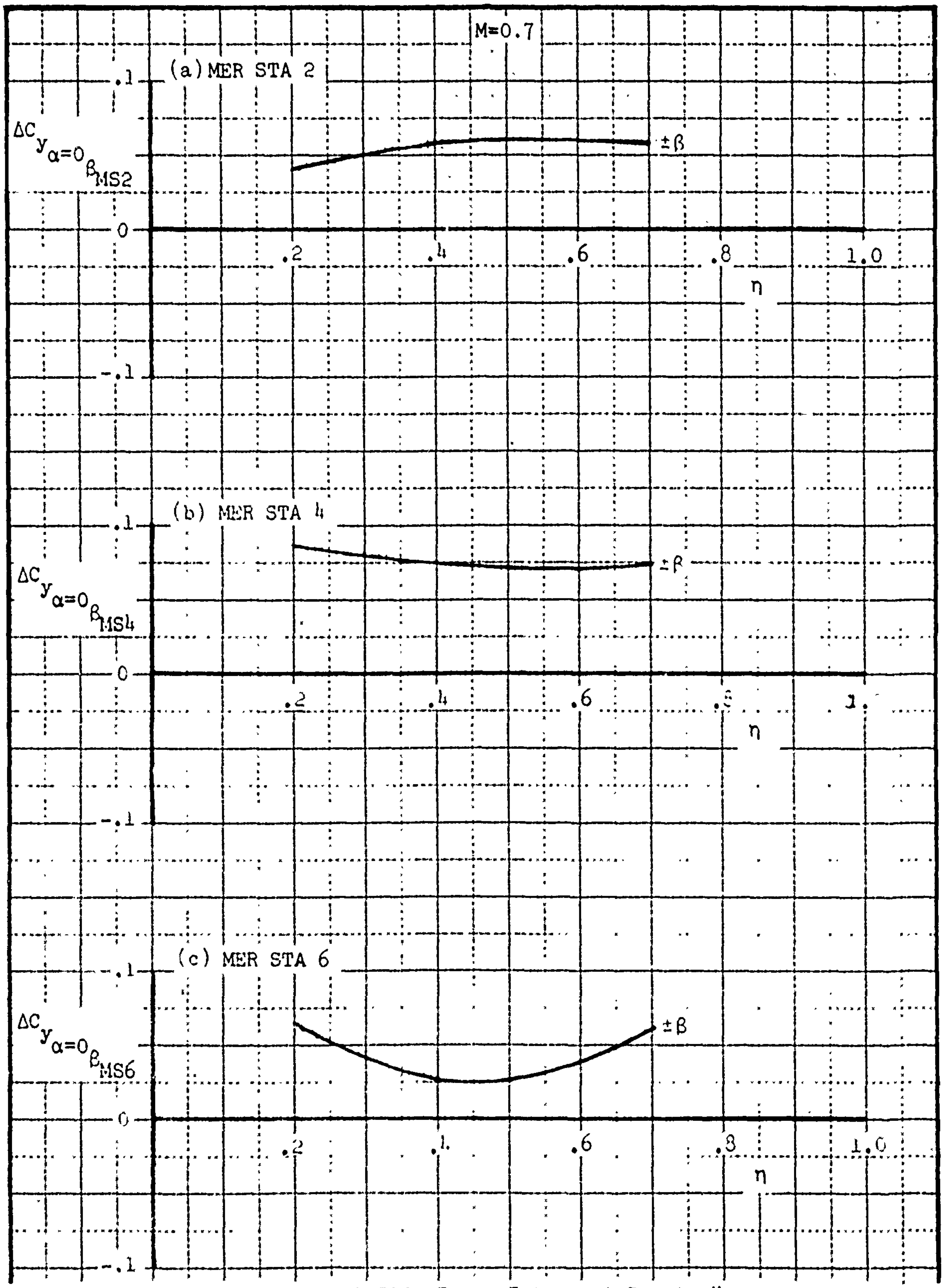



Figure 392. Incremental Side Force Intercept Due to Yaw - Spanwise Correction at M=0.7 for MER Stations 2,4, and 6

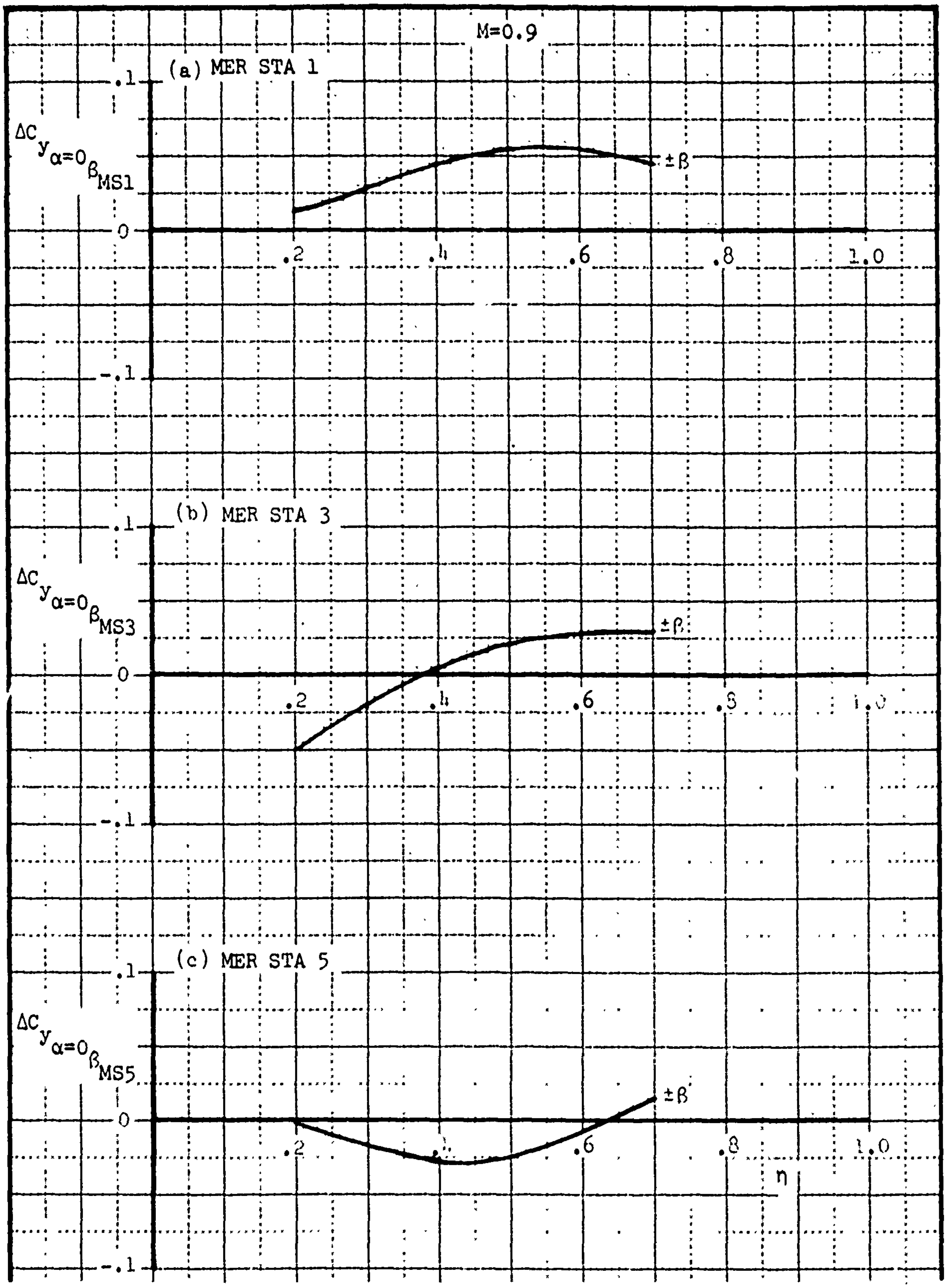



Figure 393. Incremental Side Force Intercept Due to Yaw - Spanwise Correction at M=0.9 for MER Stations 1,3, and 6

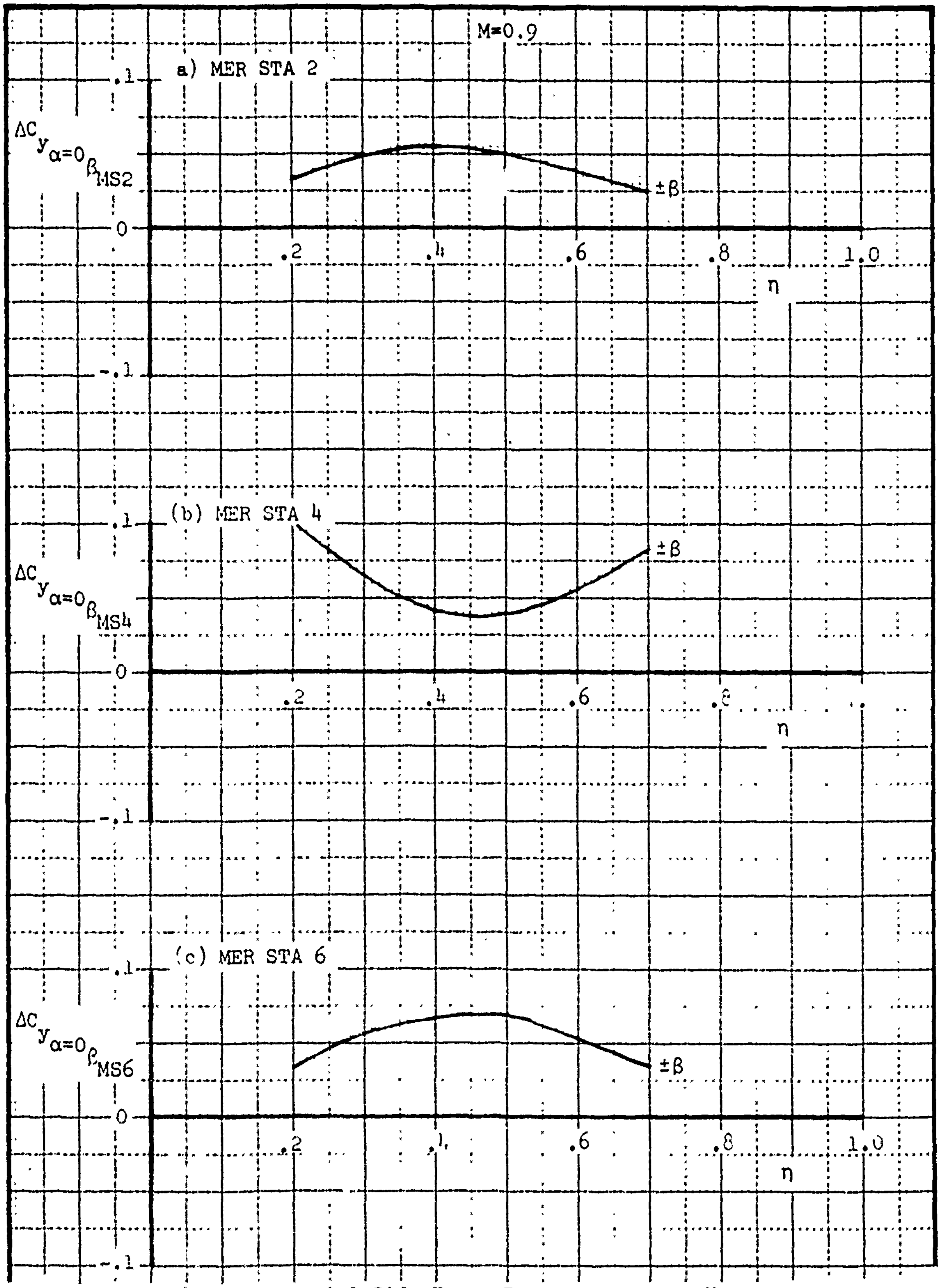



Figure 394. Incremental Side Force Intercept Due to Yaw - Spanwise Correction at M=0.9 for MER Stations 2,4, and 6

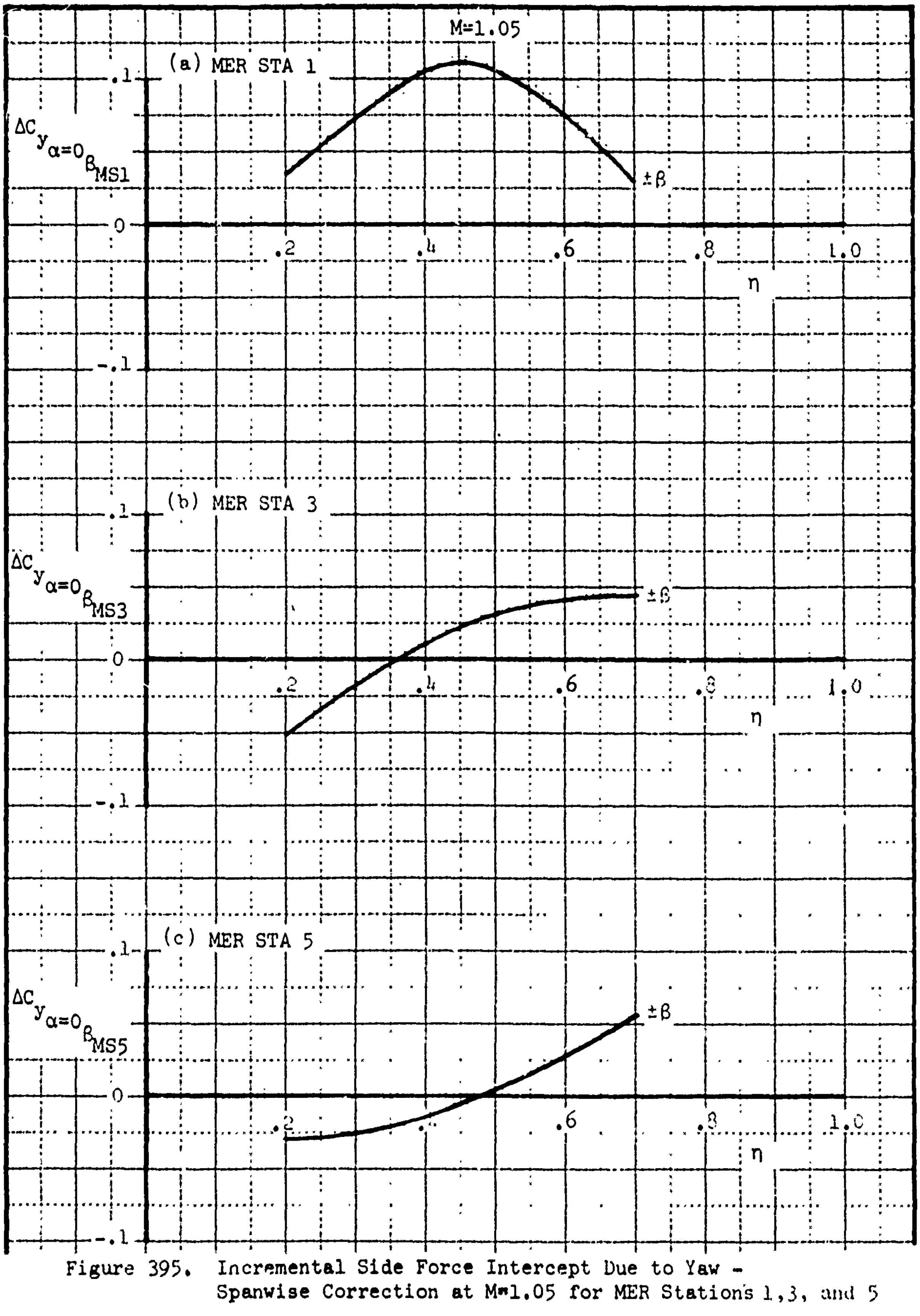



Figure 395. Incremental Side Force Intercept Due to Yaw - Spanwise Correction at M=1.05 for MER Stations 1, 3, and 5

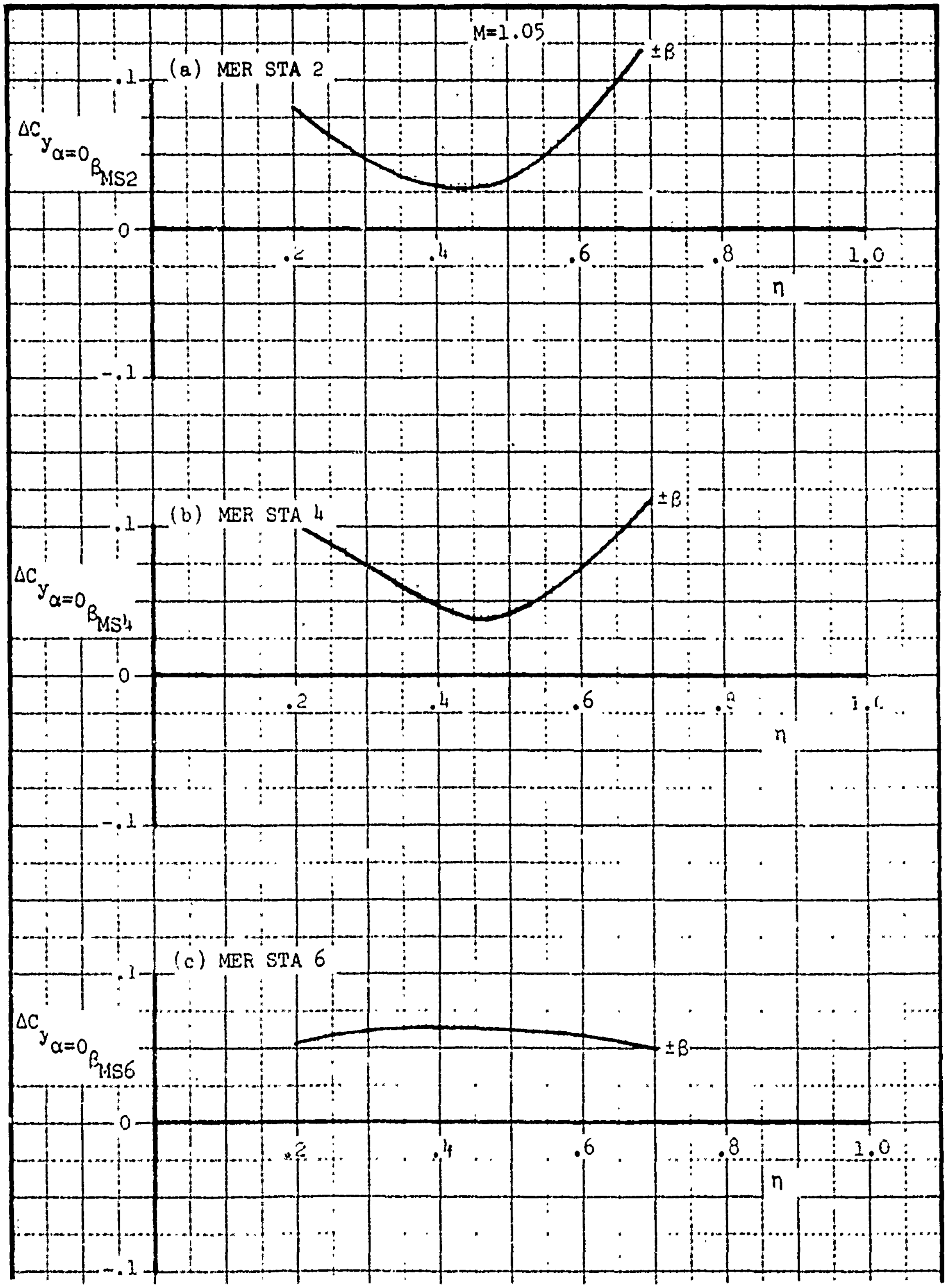



Figure 396. Incremental Side Force Intercept Due to Yaw - Spanwise Correction at M=1.05 for MER Stations 2, 4, and 6

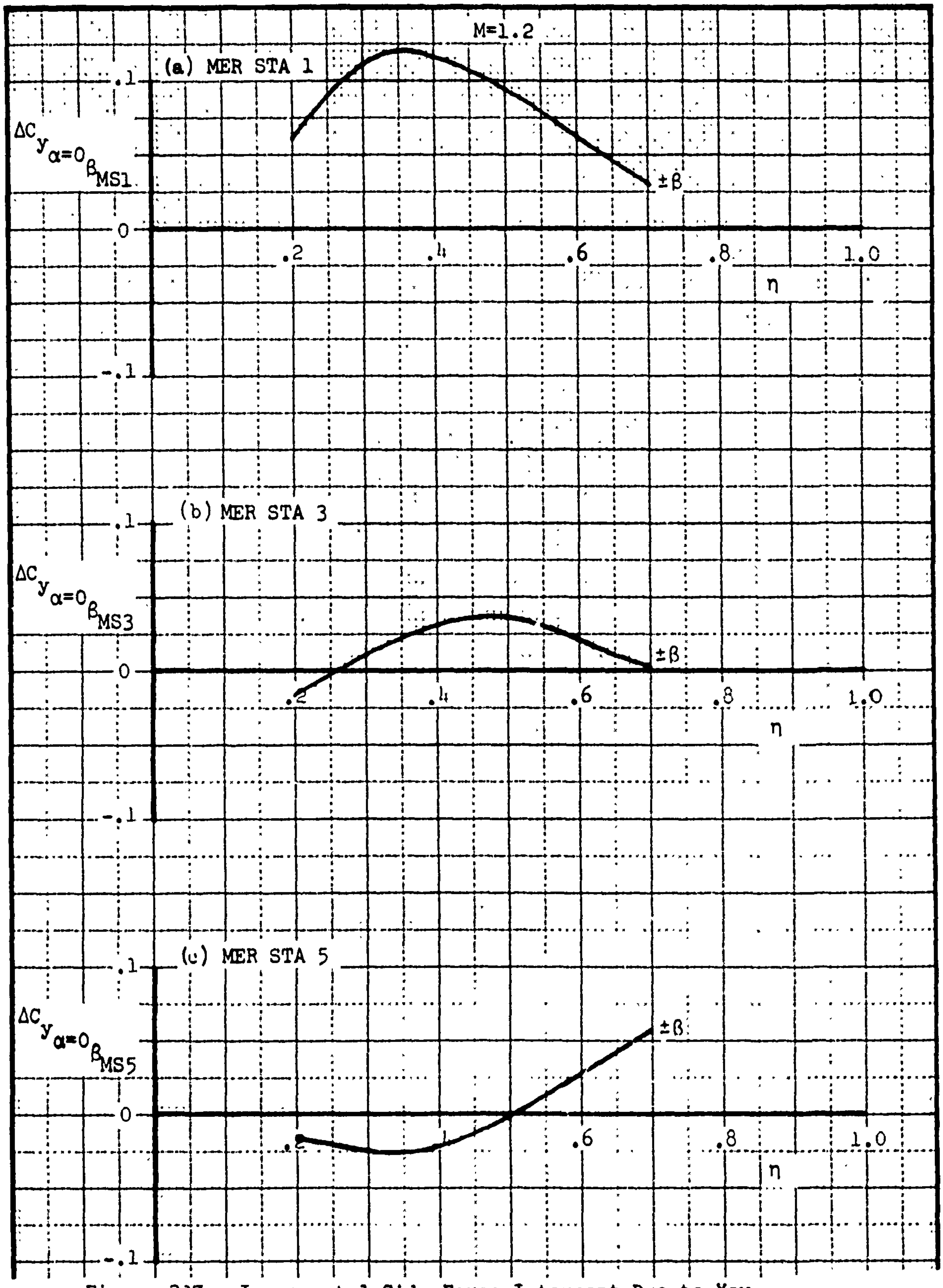



Figure 397. Incremental Side Force Intercept Due to Yaw - Spanwise Correction at M=1.2 for MER Stations 1,3, and 5

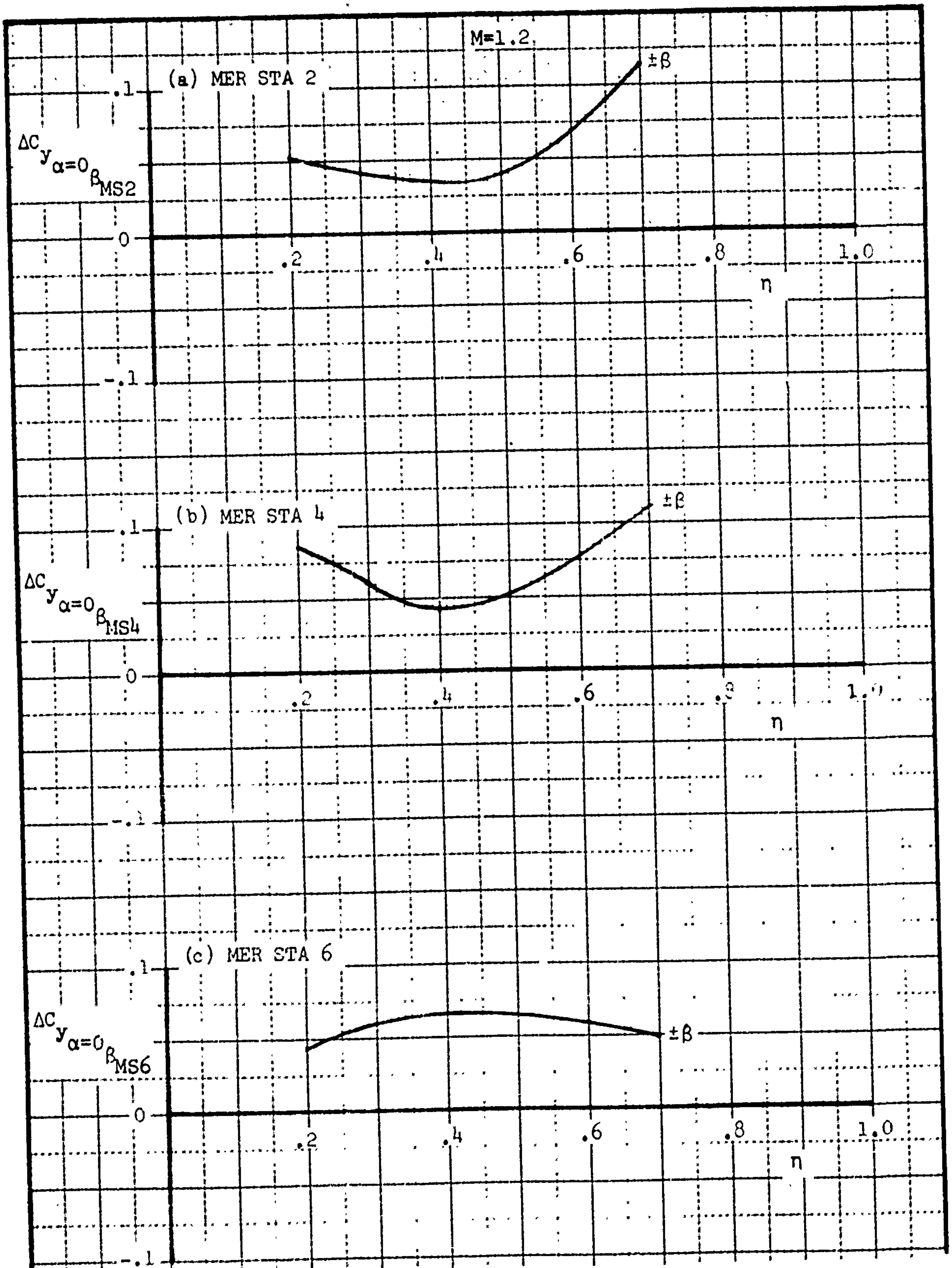



Figure 398. Incremental Side Force Intercept Due to Yaw - Spanwise Correction at M=1.2 for MER Stations 2,4, and 6

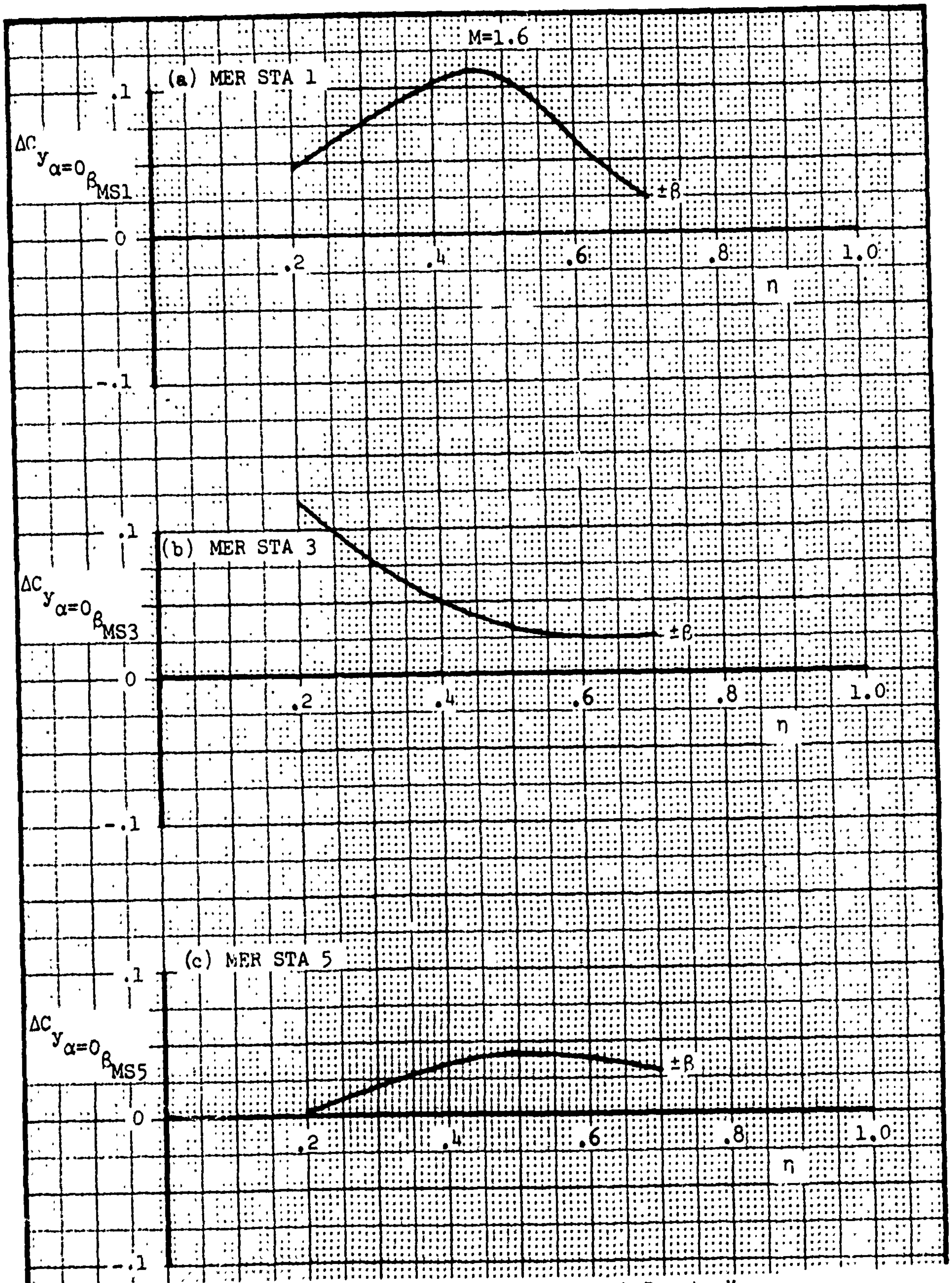



Figure 399. Incremental Side Force Intercept Due to Yaw - Spanwise Correction at M=1.6 for MER Stations 1,3 and 5

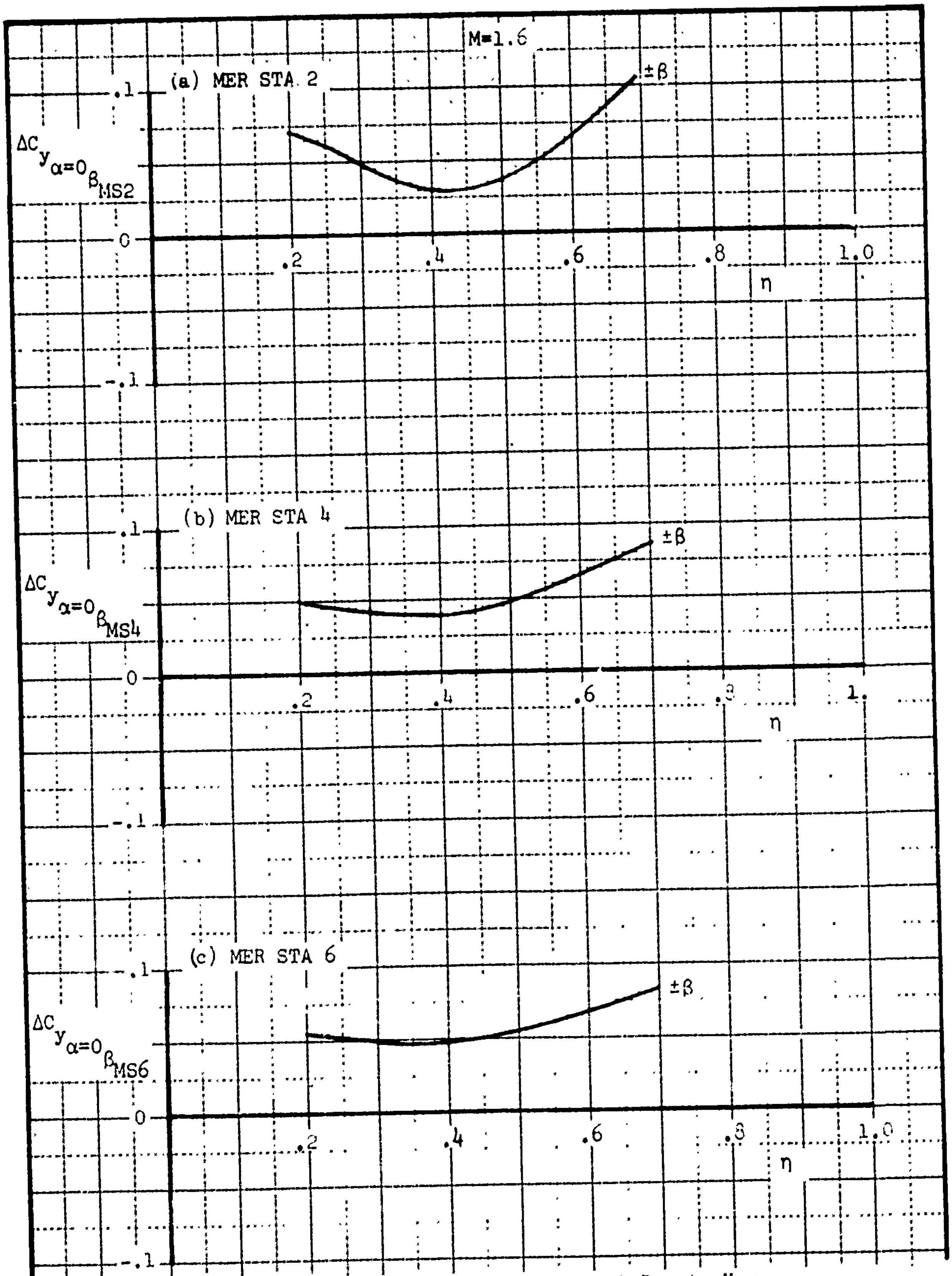



Figure 400. Incremental Side Force Intercept Due to Yaw - Spanwise Correction at M=1.6 for MER Stations 2,4, and 6

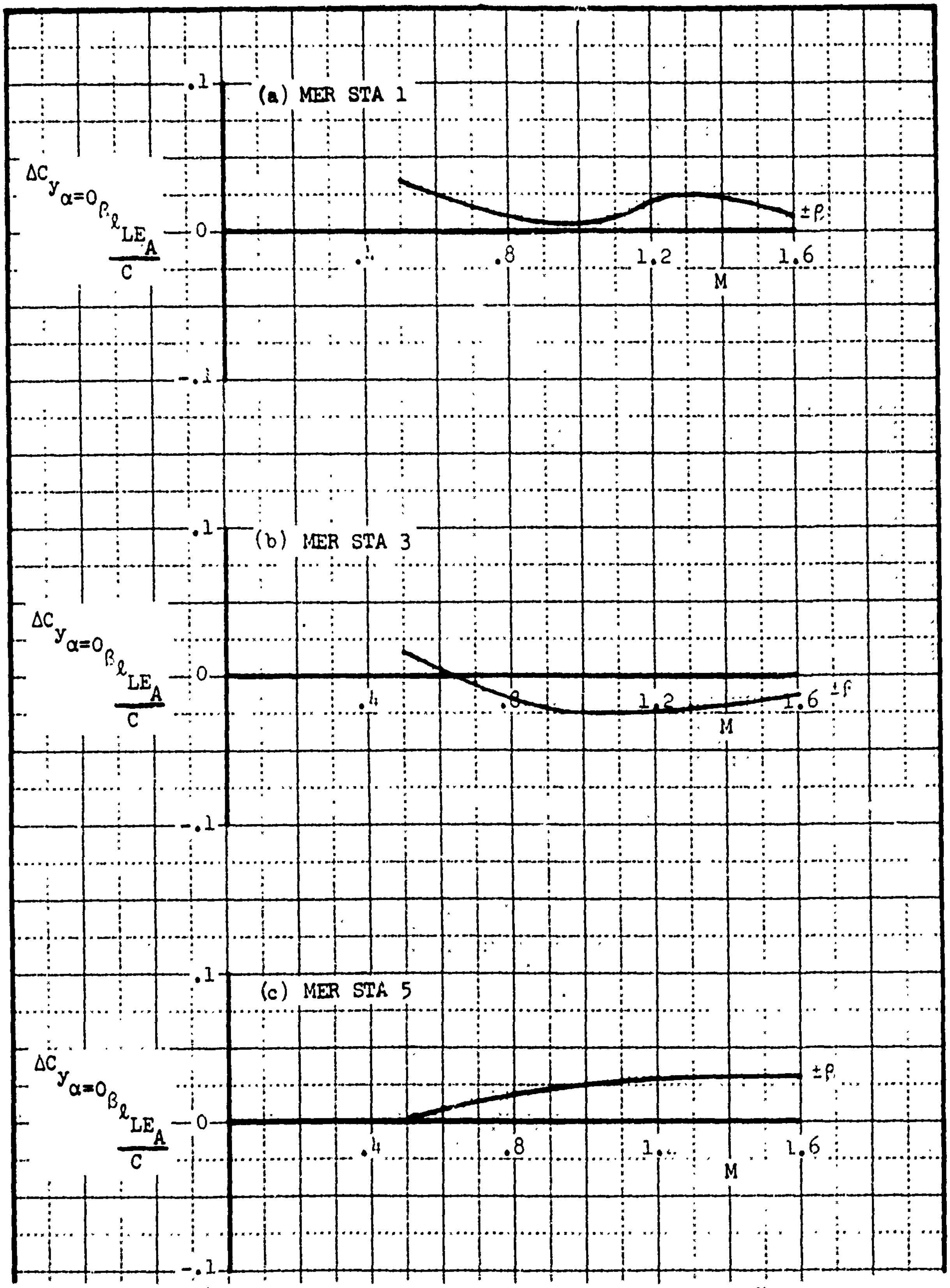



Figure 401. Incremental Side Force Intercept Due to Yaw - Chordwise Correction for MER Stations 1,3, and 5

4.1.3 Increment - Adjacent Store Interference

Methods to predict the increment in captive store side force variation with angle of attack, $\Delta\left(\frac{SF}{q}\right)_{\alpha_{INTF}}$, and the value at $\alpha=0$, $\Delta\left(\frac{SF}{q}\right)_{\alpha=0_{INTF}}$, for multiple carried stores are presented within this section. The basic prediction is made as a function of minimum store to store separation distance $y_{INTF}$ (see Subsection 3.1.3), at discrete Mach numbers. The data are presented separately for the aft cluster of stores on MER STATIONS 1, 3, and 5, and the forward cluster, MER STATIONS 2, 4, and 6. Predictions are also separately made for inboard → outboard interference, the interfering store carried inboard of the subject captive store, and outboard → inboard interference, the interfering store carried outboard of the subject captive store. On the curves defining the basic prediction ADJ.SHOULDER refers to the MER shoulder store adjacent to the interfering store, OPPOSITE SHOULDER is the MER shoulder store furthest displaced laterally from the interfering store, and ℄ STORE is the MER centerline store, MER STATION 1 or 2.

4.1.3.1 Slope Prediction

The equations governing the prediction of incremental side force variation with angle of attack are presented below.

INTERFERING STORES CARRIED INBOARD

MER STATIONS 1,2,3,4,5, and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_{\substack{INTF\\MS1-6}}} = \left(\sum \Delta C_{y_{\alpha_{\substack{INTF\\IB\to OB\\MS1-6}}}}\right) K_{SCALE_{SF}}$$

where:

$\Delta C_{y_{\alpha_{\substack{INTF \\ IB\rightarrow OB}}}}$ - Incremental side force slope coefficient due to inboard to outboard interference as a function of $y_{INTF}$, $\frac{1}{deg}$, see Table 9.

$K_{SCALE_{SF}}$ - Side force scale factor, $ft^2$, see Section IV.

INTERFERING STORES CARRIED OUTBOARD

MER STATIONS 1,2,3,4,5, and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_{\substack{INTF \\ MS1-6}}} = \left(\sum \Delta C_{y_{\alpha_{\substack{INTF \\ OB\rightarrow IB \\ MS1-6}}}}\right) K_{SCALE_{SF}}$$

where:

$\Delta C_{y_{\alpha_{\substack{INTF \\ OB\rightarrow IB}}}}$ - Incremental side force slope coefficient due to outboard to inboard interference as a function of $y_{INTF}$, $\frac{1}{deg}$, see Table 9.

$K_{SCALE_{SF}}$ - Side force scale factor, $ft^2$, see Section IV.

INTERFERING STORES CARRIED INBOARD AND OUTBOARD

MER STATIONS 1,2,3,4,5, and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{SF}{q}\right)_{\alpha_{\substack{INTF \\ MS1-6}}} = \left[K_{INTC_1} + K_{SLOPE_1}\left(\sum \Delta C_{y_{\alpha_{\substack{INTF \\ IB\rightarrow OB \\ MS1-6}}}} + \sum \Delta C_{y_{\alpha_{\substack{INTF \\ OB\rightarrow IB \\ MS1-6}}}}\right)\right] K_{SCALE_{SF}}$$

where:

$K_{INTC_1}$ - Intercept for the inboard - outboard combination correction for side force slope, $\frac{1}{deg}$, Figure 418.

$K_{SLOPE_1}$ - Slope for the inboard-outboard combination correction for side force slope, Figure 41[illegible].

$\Delta C_{y_{\alpha_{\substack{INTF \\ IB \to OB}}}}$ - Previously defined.

$\Delta C_{y_{\alpha_{\substack{INTF \\ OB \to IB}}}}$ - Previously defined.

$K_{SCALE_{SF}}$ - Side force scale factor, $ft^2$, see Section IV.

The above equations define the interference increment calculation at a given Mach number. For Mach numbers other than those presented, M = 0.7, 0.9, 1.05, 1.2, 1.6, these guidelines should be followed. If the subject Mach number is less than M = 0.7, use the value at M = 0.7. For other Mach numbers linear interpolation should be used between the Mach numbers which are presented.

TABLE 9. INCREMENTAL SIDE FORCE SLOPE COEFFICIENT DUE TO INTERFERENCE - FIGURE LOCATION GUIDE

| $\Delta C_{y_{\alpha_{INTF}}}$ | MACH NUMBER 0.7 | 0.9 | 1.05 | 1.2 | 1.6 |
|---|---|---|---|---|---|
| | Figure Number | | | | |
| Adj. Shoulder-Fwd. Cluster | 402 | 403 | 404 | 405 | 406 |
| Adj. Shoulder-Aft Cluster | 402 | 403 | 404 | 405 | 406 |
| ℄ Store-Fwd. Cluster | 407 | 408 | 409 | 410 | 411 |
| ℄ Store-Aft Cluster | 407 | 408 | 409 | 410 | 411 |
| Opposite Shoulder-Fwd. Cluster | 412 | 413 | 414 | 415 | 416 |
| Opposite Shoulder-Aft Cluster | 412 | 413 | 414 | 415 | 416 |

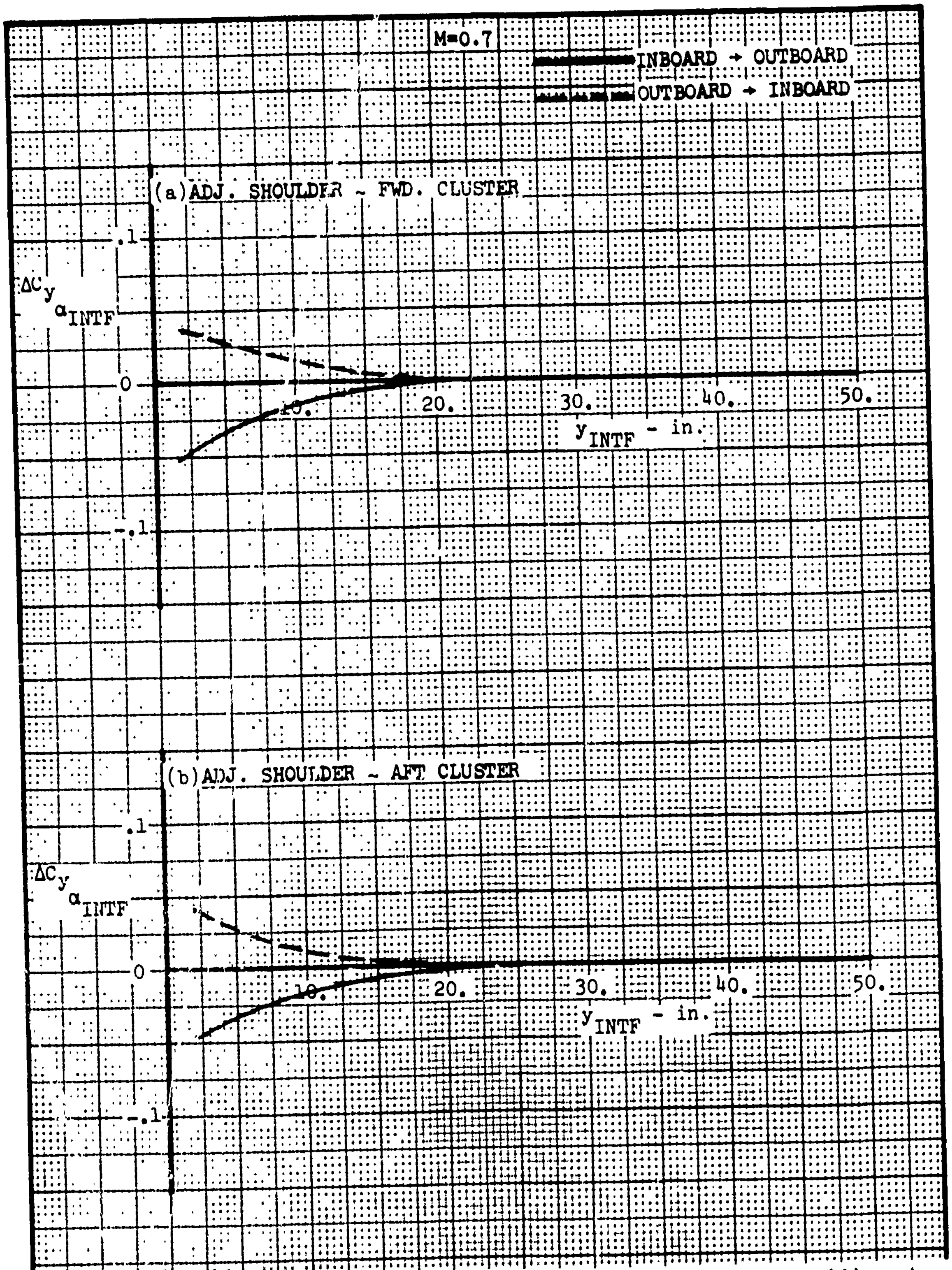



Figure 402. Incremental Side Force Slope Due to Interference - Adjacent Shoulder at M=0.7

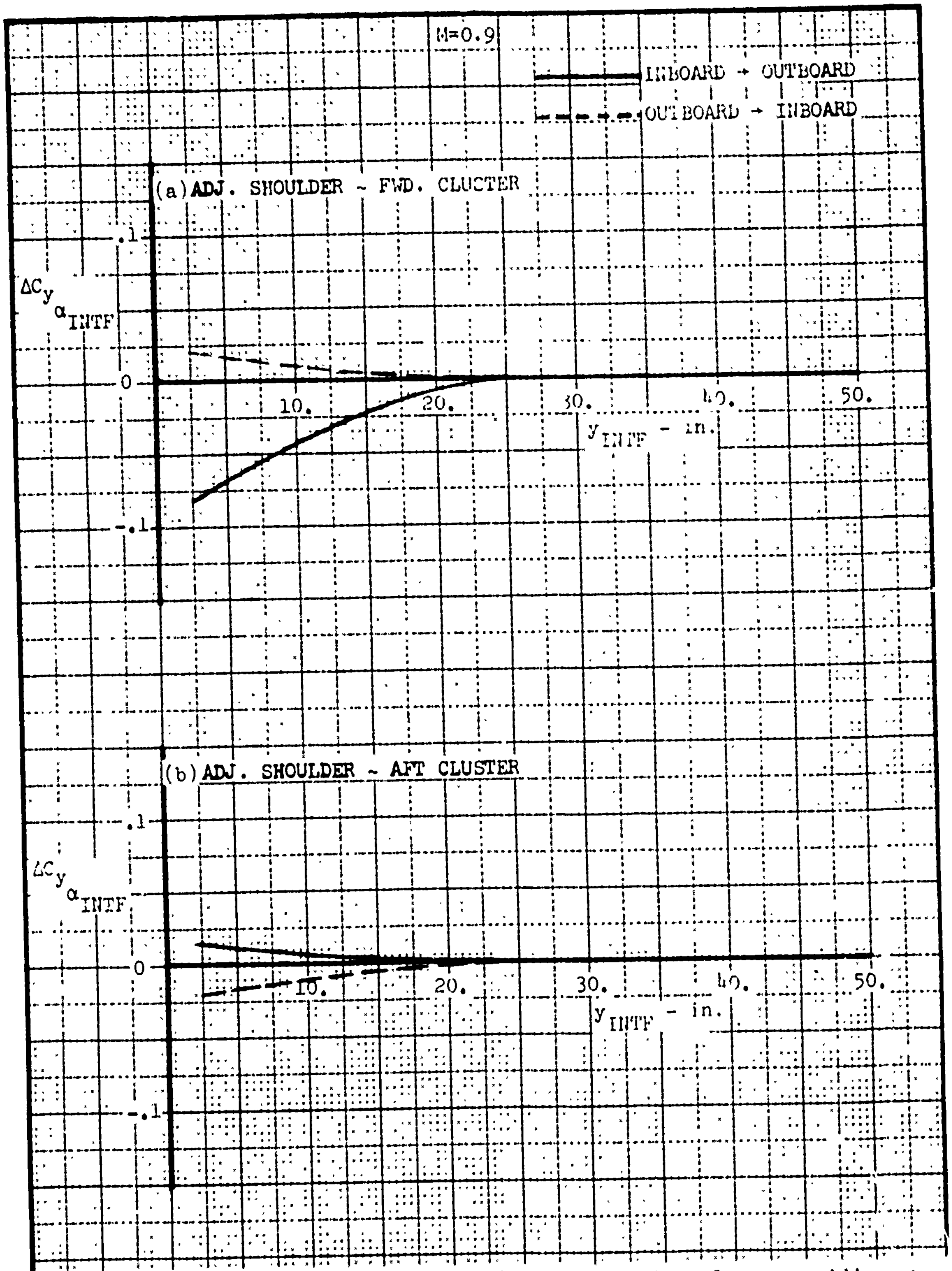



Figure 403. Incremental Side Force Slope Due to Interference - Adjacent Shoulder at M=0.9

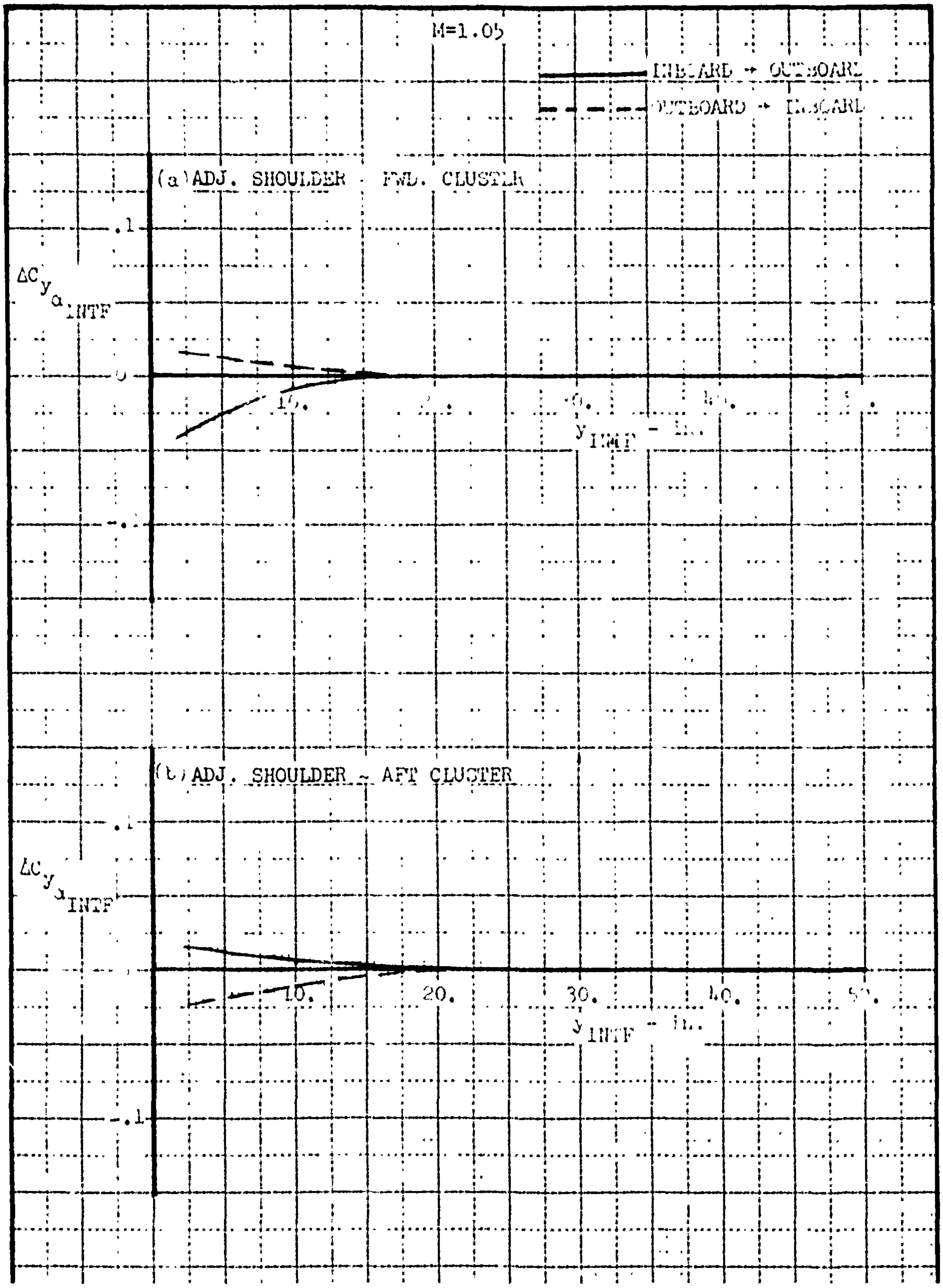



Figure 404. Incremental Side Force Slope Due to Interference - Adjacent Shoulder at M=1.05

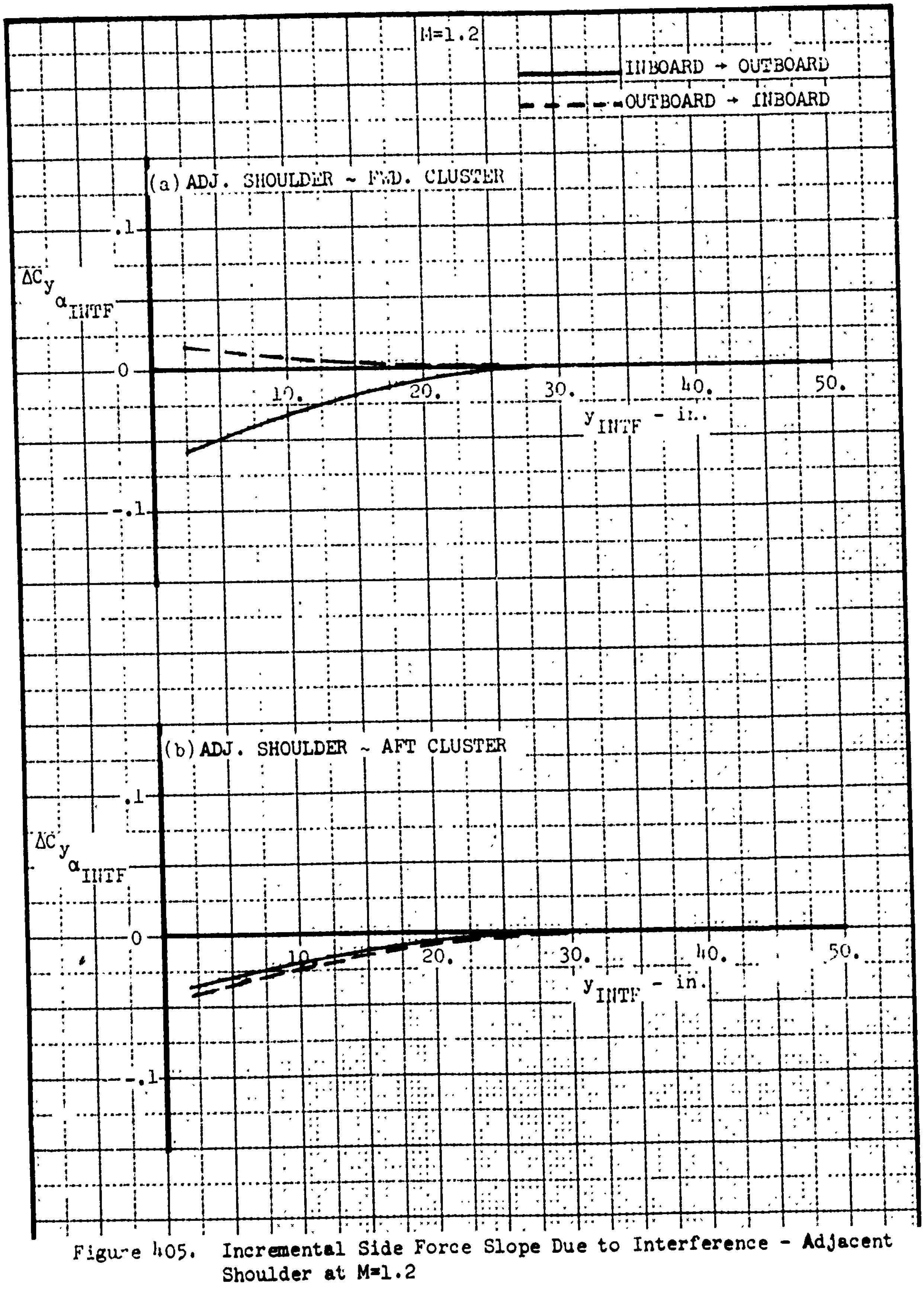



Figure 405. Incremental Side Force Slope Due to Interference - Adjacent Shoulder at M=1.2

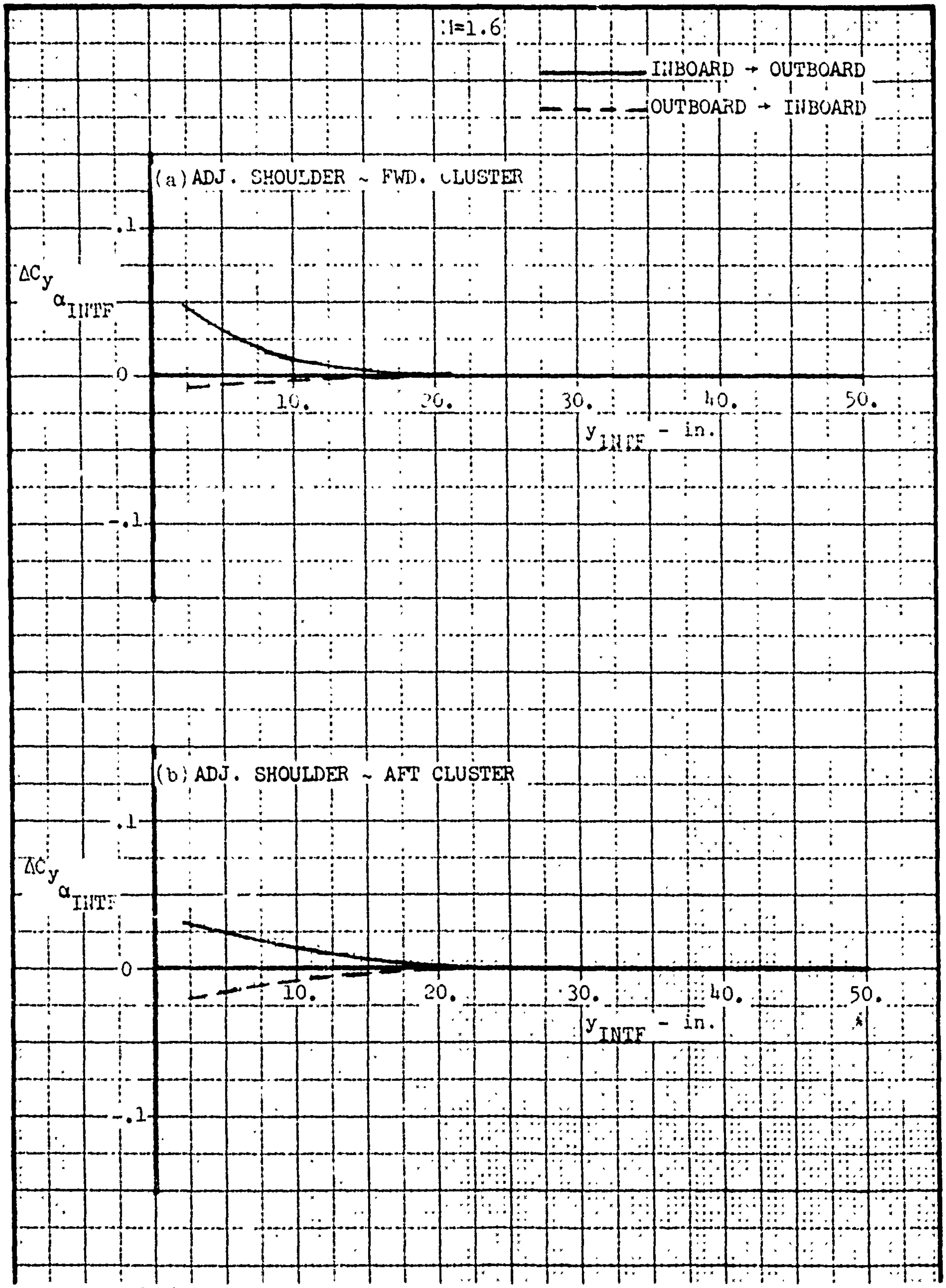



Figure 406. Incremental Side Force Slope Due to Interference - Adjacent Shoulder at M=1.6

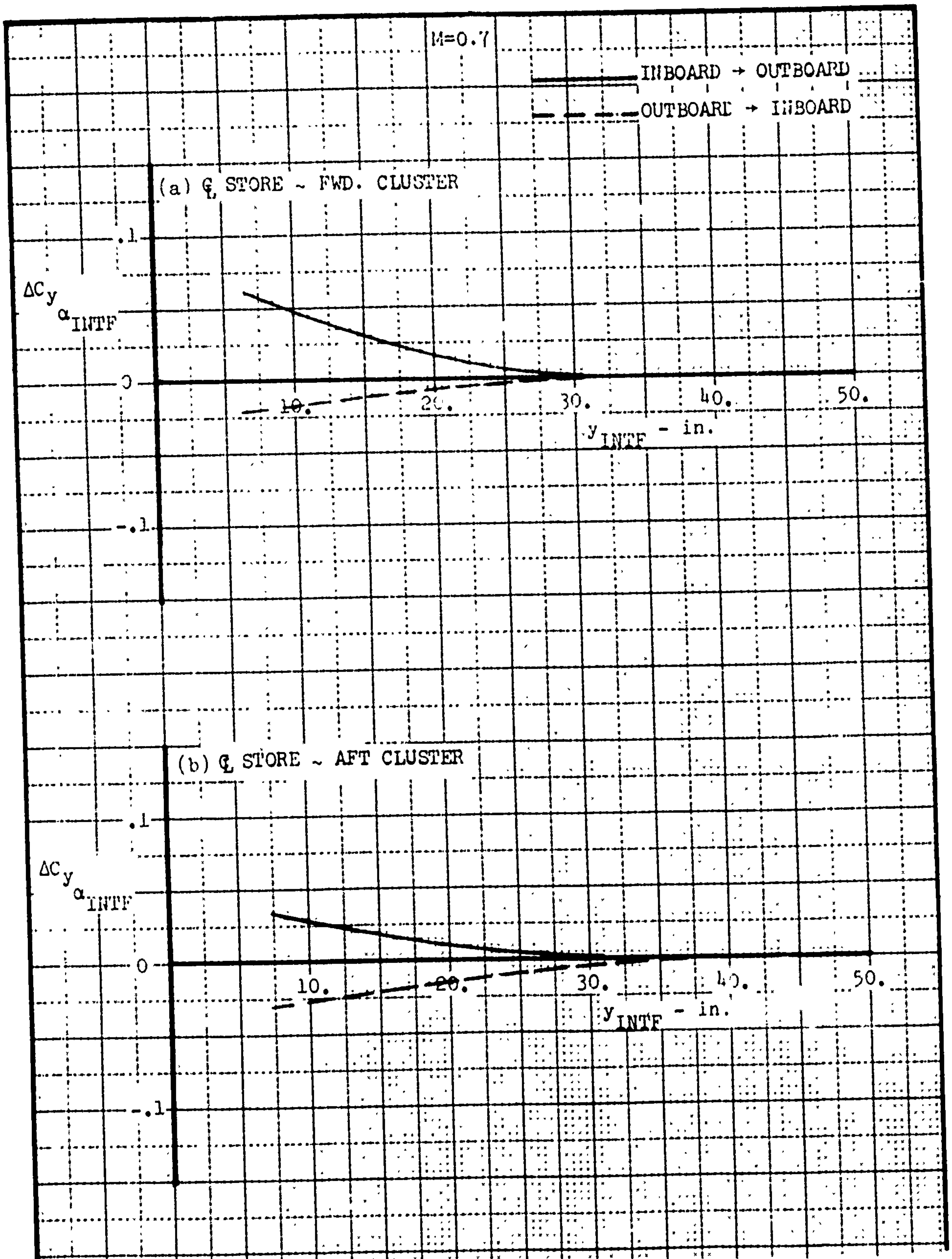



Figure 407. Incremental Side Force Slope Due to Interference - Centerline Store at M=0.7

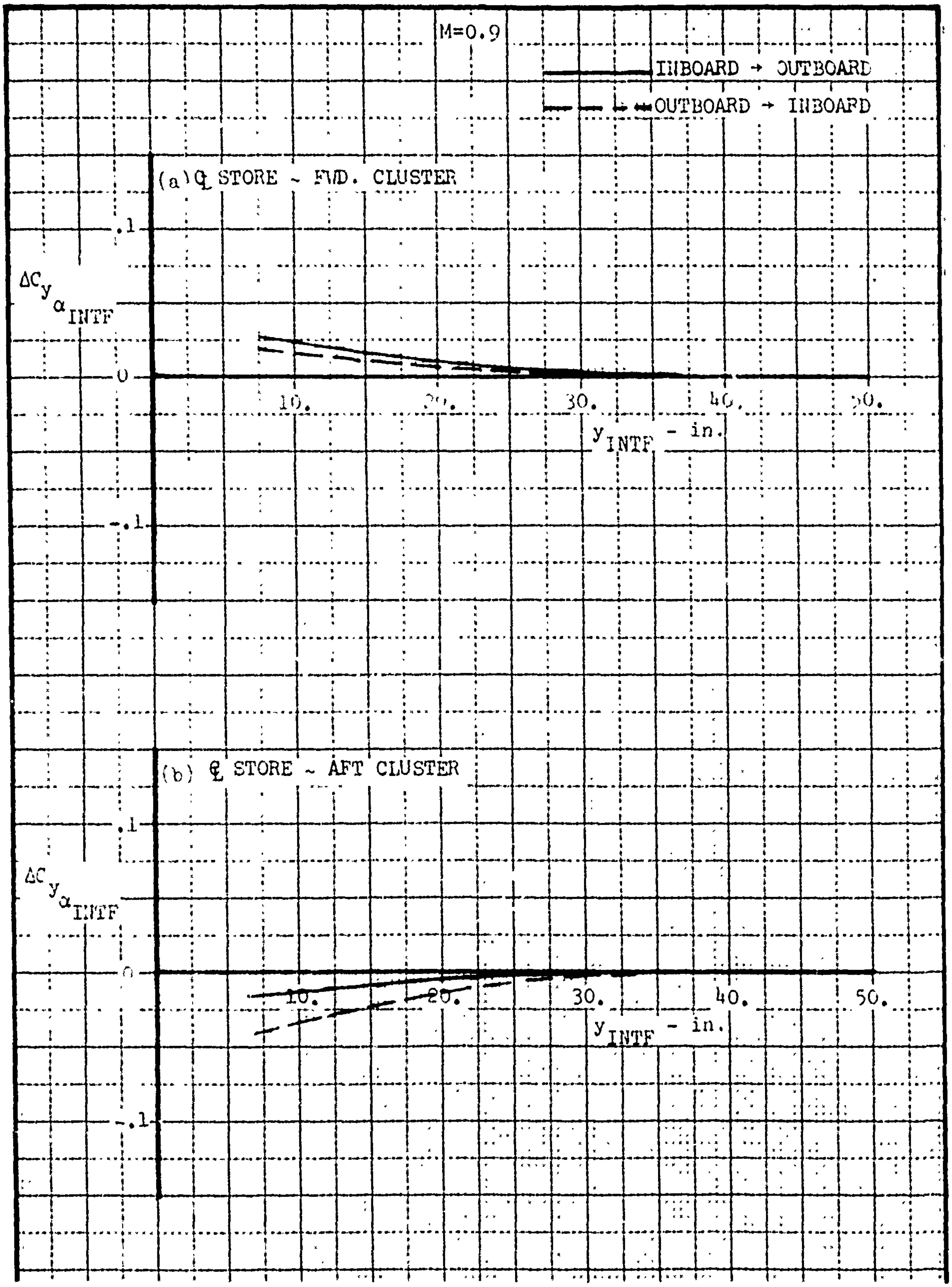



Figure 408. Incremental Side Force Slope Due to Interference - Centerline Store at M=0.9

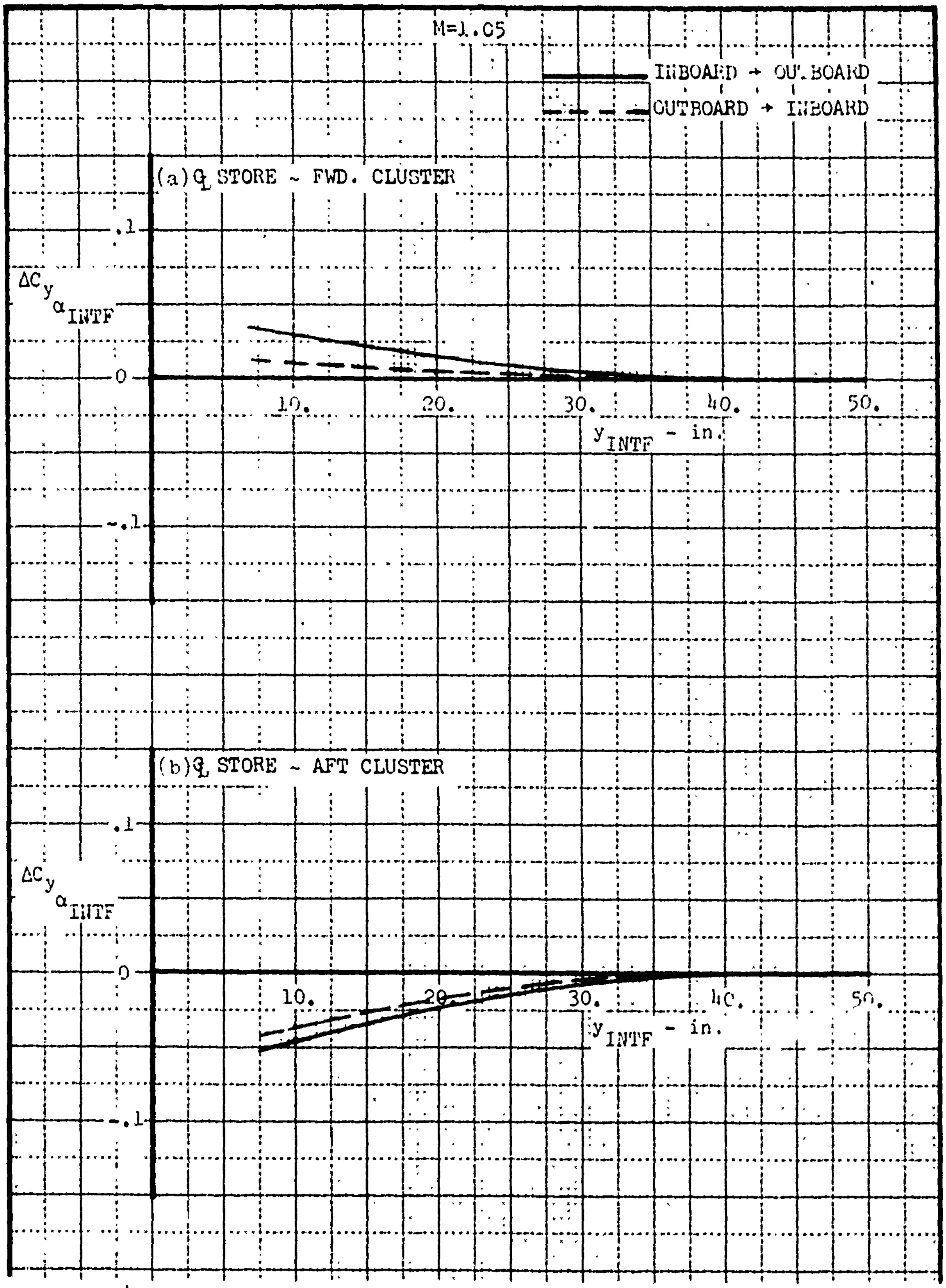



Figure 409. Incremental Side Force Slope Due to Interference - Centerline Store at M=1.05

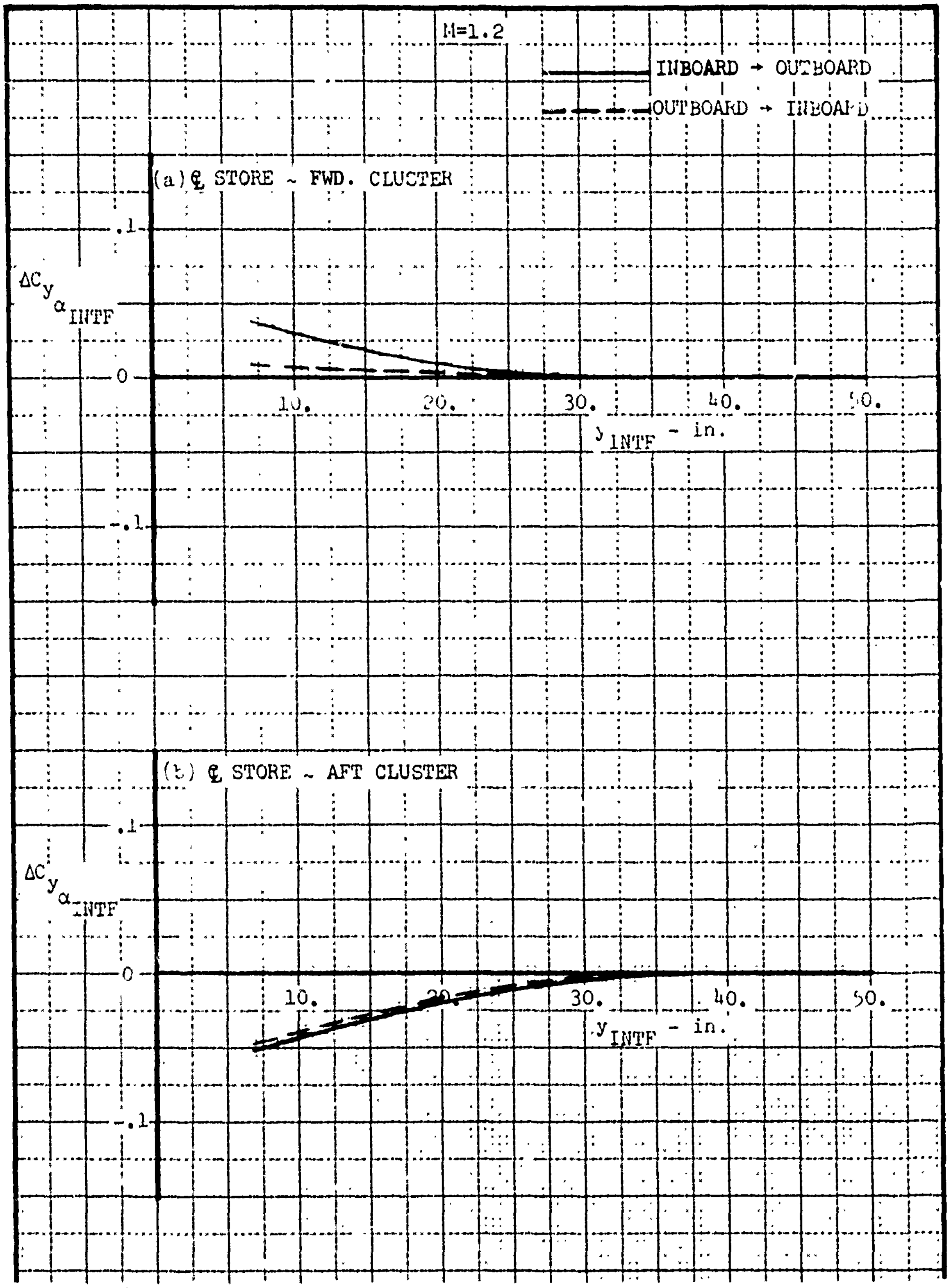



Figure 410. Incremental Side Force Slope Due to Interference - Centerline Store at M=1.2

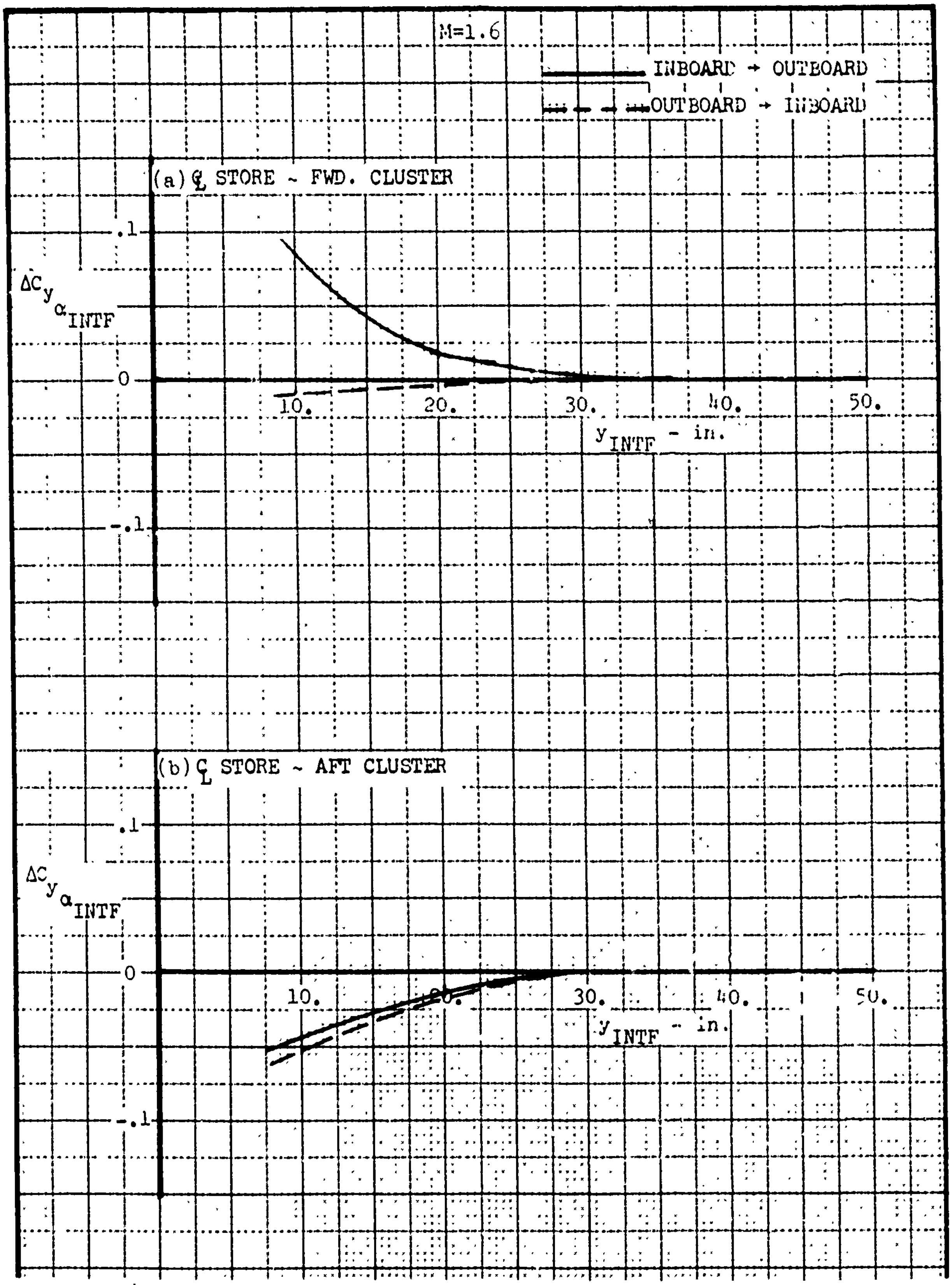



Figure 411. Incremental Side Force Slope Due to Interference - Centerline Store at M=1.6

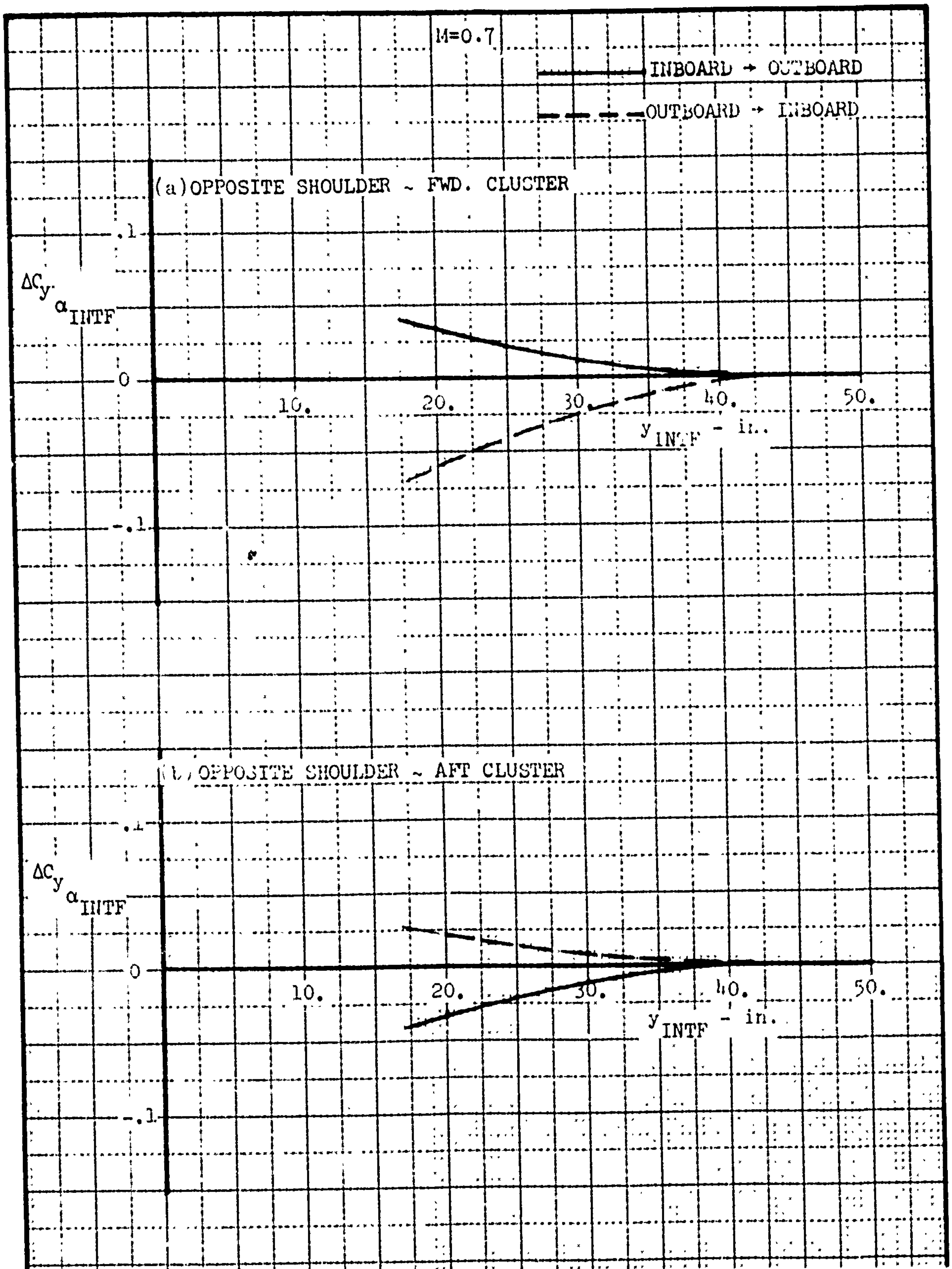



Figure 412. Incremental Side Force Slope Due to Interference - Opposite Shoulder at M = 0.7

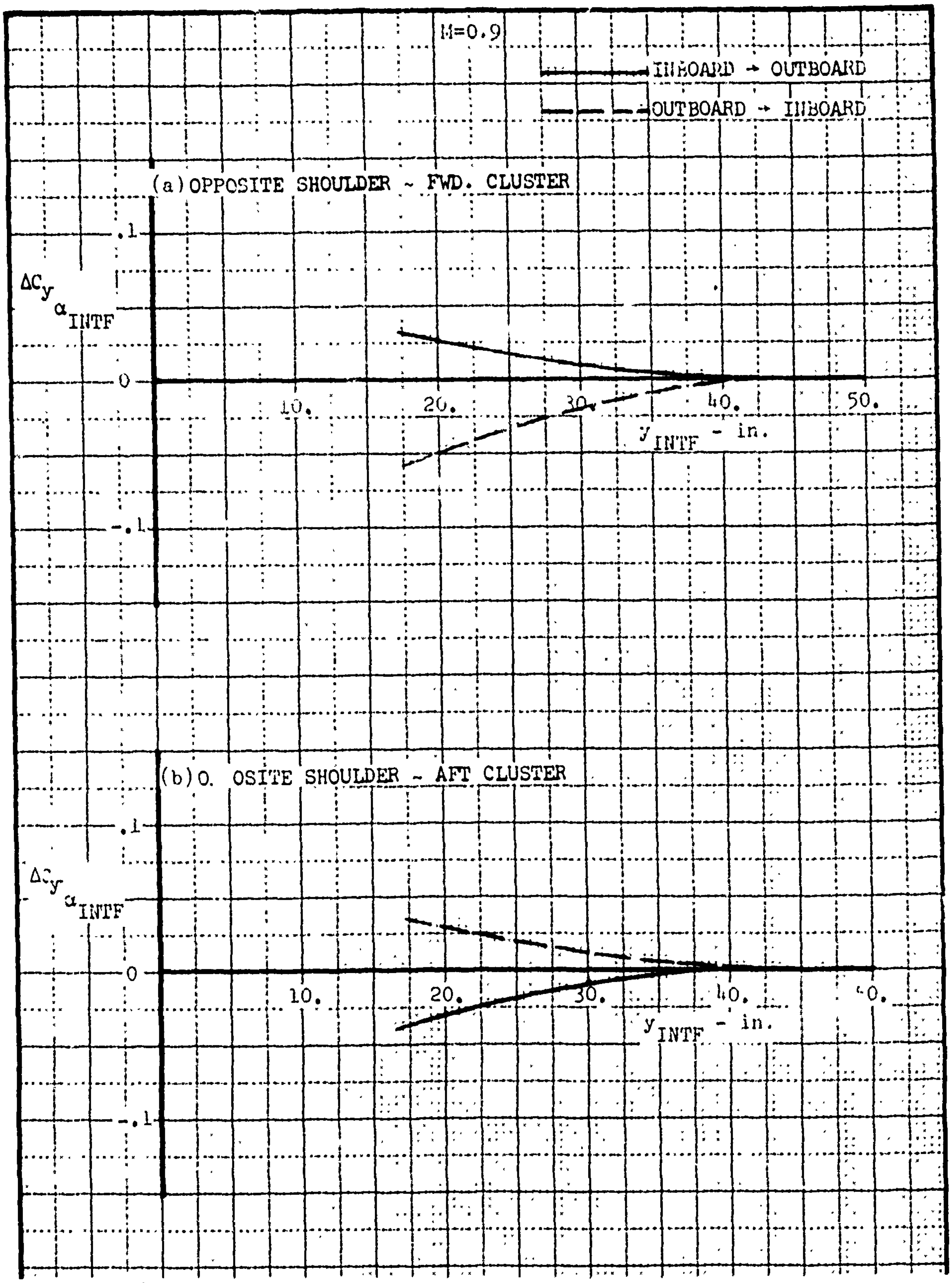



Figure 413. Incremental Side Force Slope Due to Interference - Opposite Shoulder at M=0.9

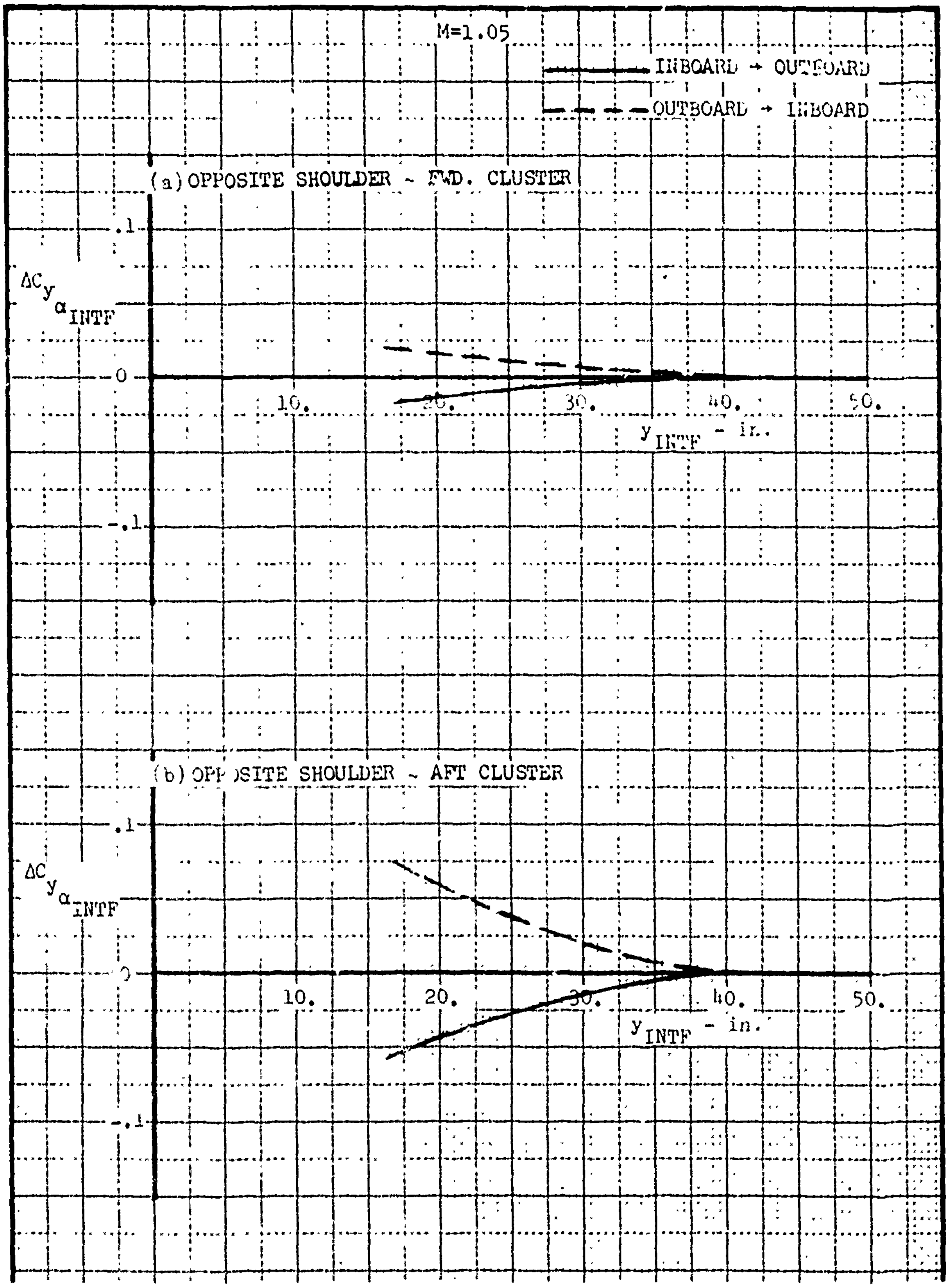



Figure 414. Incremental Side Force Slope Due to Interference - Opposite Shoulder at M=1.05

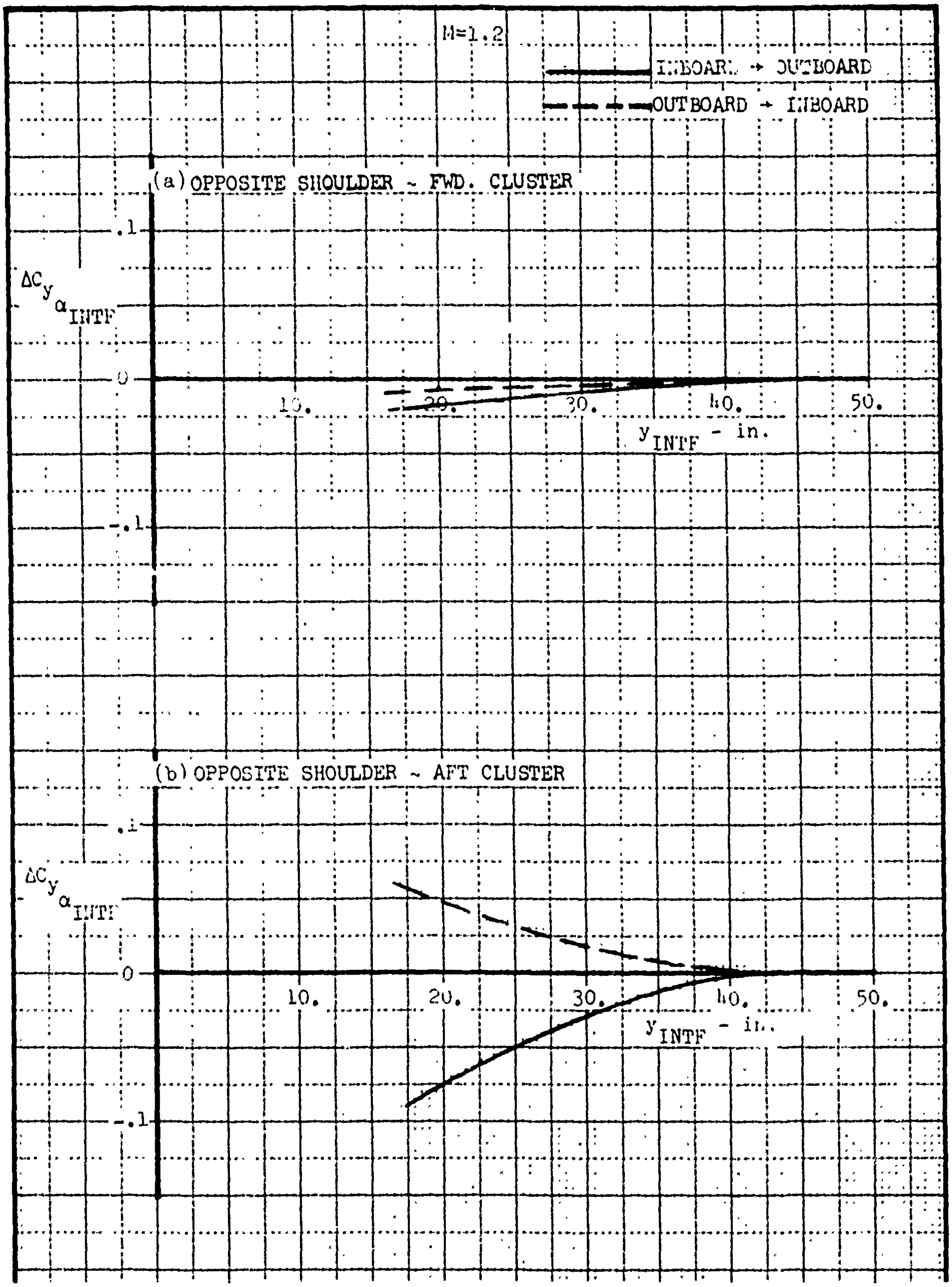



Figure 415. Incremental Side Force Slope Due to Interference - Opposite Shoulder at M=1.2

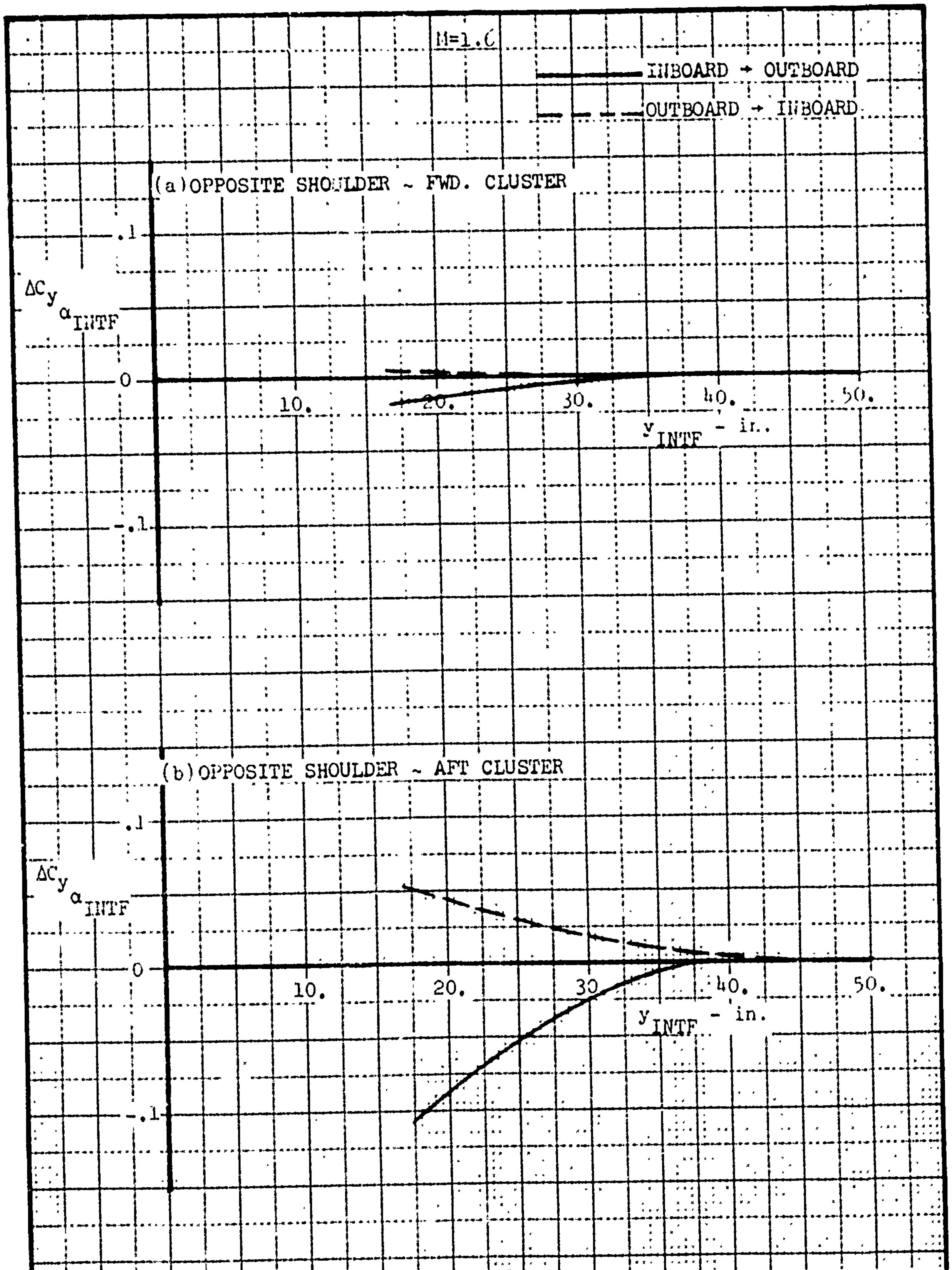



Figure 416. Incremental Side Force Slope Due to Interference - Opposite Shoulder at M=1.6

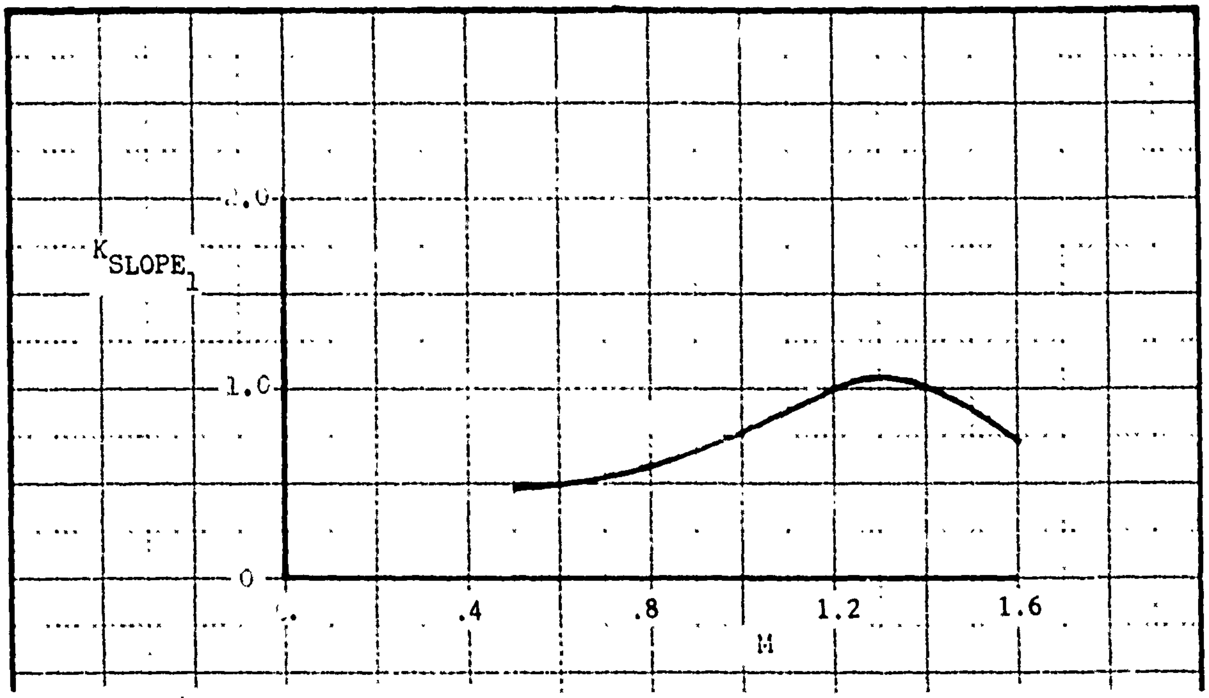



Figure 417. Incremental Side Force Slope Due to Interference - $K_{SLOPE_1}$ for Combination Inboard and Outboard Interference

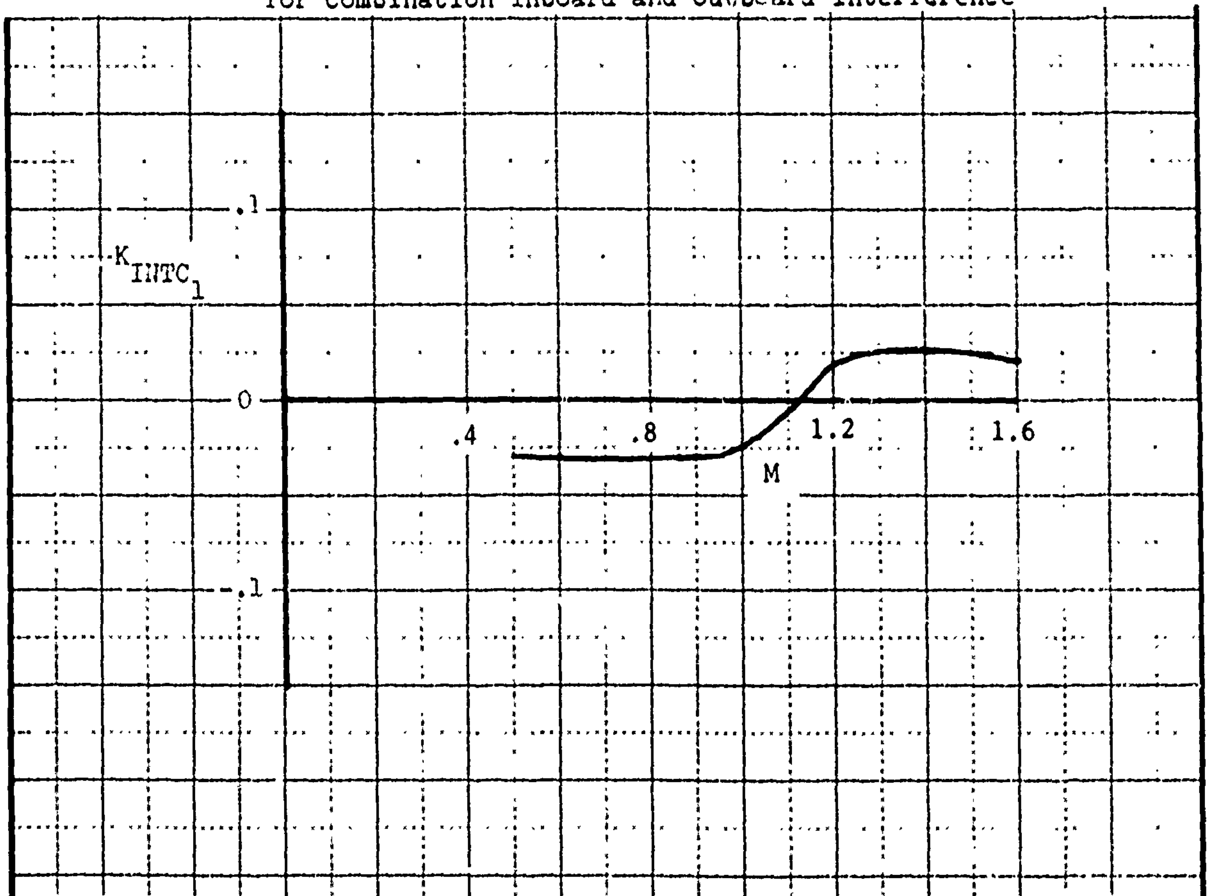



Figure 418. Incremental Side Force Slope Due to Interference - $K_{INTC_1}$ for Combination Inboard and Outboard Interference

4.1.3.2 Intercept Prediction

The equations governing the prediction of incremental side force intercept are presented below.

INTERFERING STORES CARRIED INBOARD

MER STATIONS 1, 2, 3, 4, 5, and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{SF}{q}\right)_{\substack{\alpha=0\\ INTF\\ MS1-6}} = \left(\sum \Delta C_{y_{\substack{\alpha=0\\ INTF\\ IB\to OB\\ MS1-6}}}\right) K_{SCALE_{SF}}$$

where:

$\Delta C_{y_{\substack{\alpha=0\\ INTF\\ IB\to OB}}}$ - Incremental side force intercept coefficient due to inboard to outboard interference as a function of $y_{INTF}$, see Table 10.

$K_{SCALE_{SF}}$ - Side force scale factor, $ft^2$, see Section IV.

INTERFERING STORES CARRIED OUTBOARD

MER STATIONS 1, 2, 3, 4, 5, and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{SF}{q}\right)_{\substack{\alpha=0\\ INTF\\ MS1-6}} \left(\sum \Delta C_{y_{\substack{\alpha=0\\ INTF\\ OB\to IB}}}\right) K_{SCALE_{SF}}$$

where:

$\Delta C_{y_{\substack{\alpha=0\\ INTF\\ OB\to IB}}}$ - Incremental side force intercept coefficient due to outboard to inboard interference as a function of $y_{INTF}$, see Table 10.

$K_{SCALE_{SF}}$ - Side force scale factor, $ft^2$, see Section IV.

<u>INTERFERING STORES CARRIED INBOARD AND OUTBOARD</u>

MER STATIONS 1, 2, 3, 4, 5, and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{SF}{q}\right)_{\substack{\alpha=0\\ INTF\\ MS1-6}} = \left[K_{INTC_2} + K_{SLOPE_2}\left(\sum \Delta C_{y_{\substack{\alpha=0\\ INTF\\ IB\to OB\\ MS1-6}}} + \sum \Delta C_{y_{\substack{\alpha=0\\ INTF\\ OB\to IB\\ MS1-6}}}\right)\right] K_{SCALE_{SF}}$$

where:

$K_{INTC_2}$ - Intercept for the inboard-outboard combination correction for side force intercept, Figure [illegible].

$K_{SLOPE_2}$ - Slope for the inboard-outboard combination correction for side force intercept, Figure [illegible].

$\Delta C_{y_{\substack{\alpha=0\\ INTF\\ IB\to OB}}}$ - Previously defined.

$\Delta C_{y_{\substack{\alpha=0\\ INTF\\ OB\to IB}}}$ - Previously defined.

$K_{SCALE_{SF}}$ - Side force scale factor, $ft^2$, see Section IV.

The above equations define the interference increment calculation at a given Mach number. For Mach numbers other than those presented, M = 0.7, 0.9, 1.05, 1.2, 1.6, these guidelines should be followed. If the subject Mach number is less than M = 0.7

use the value at M = 0.7. For other Mach numbers linear interporation should be used between the Mach numbers which are presented.

TABLE 10. INCREMENTAL SIDE FORCE INTERCEPT COEFFICIENT DUE TO INTERFERENCE - FIGURE LOCATION GUIDE

| $\Delta C_{y_{\alpha=0}}$ INTF | MACH NUMBER 0.7 | 0.9 | 1.05 | 1.2 | 1.6 |
|---|---|---|---|---|---|
| | Figure Number | | | | |
| Adj. Shoulder-Fwd. Cluster | 419 | 420 | 421 | [illegible] | [illegible] |
| Adj. Shoulder-Aft Cluster | 419 | 420 | 421 | [illegible] | 423 |
| ℄ Store-Fwd. Cluster | 424 | 425 | 426 | [illegible] | [illegible] |
| ℄ Store-Aft Cluster | 424 | 425 | 426 | 427 | [illegible] |
| Opposite Shoulder-Fwd. Cluster | 429 | 430 | 431 | [illegible] | 433 |
| Opposite Shoulder-Aft Cluster | 429 | 430 | 431 | [illegible] | [illegible] |

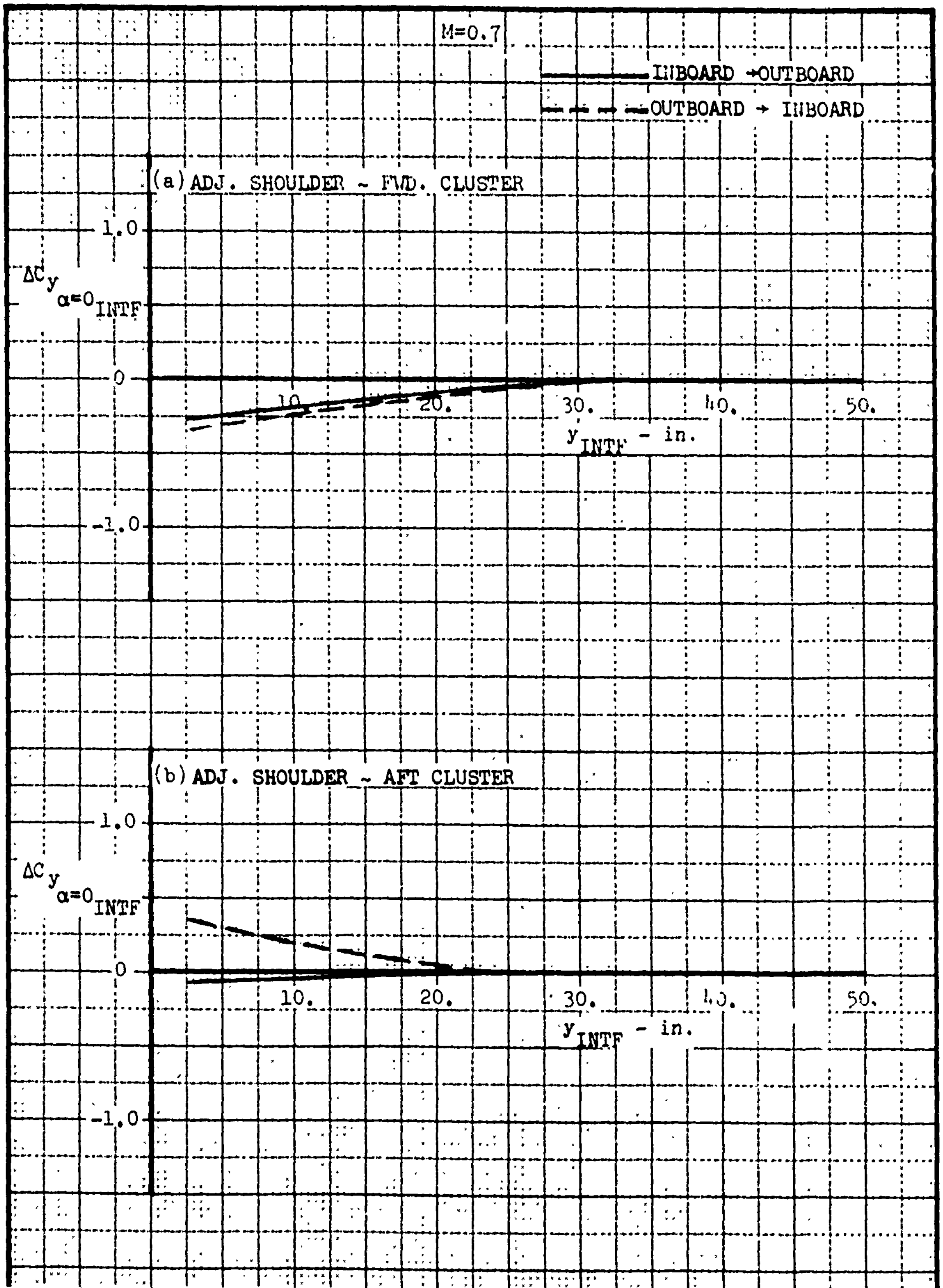



Figure 419. Incremental Side Force Intercept Due to Interference - Adjacent Shoulder at M=0.7

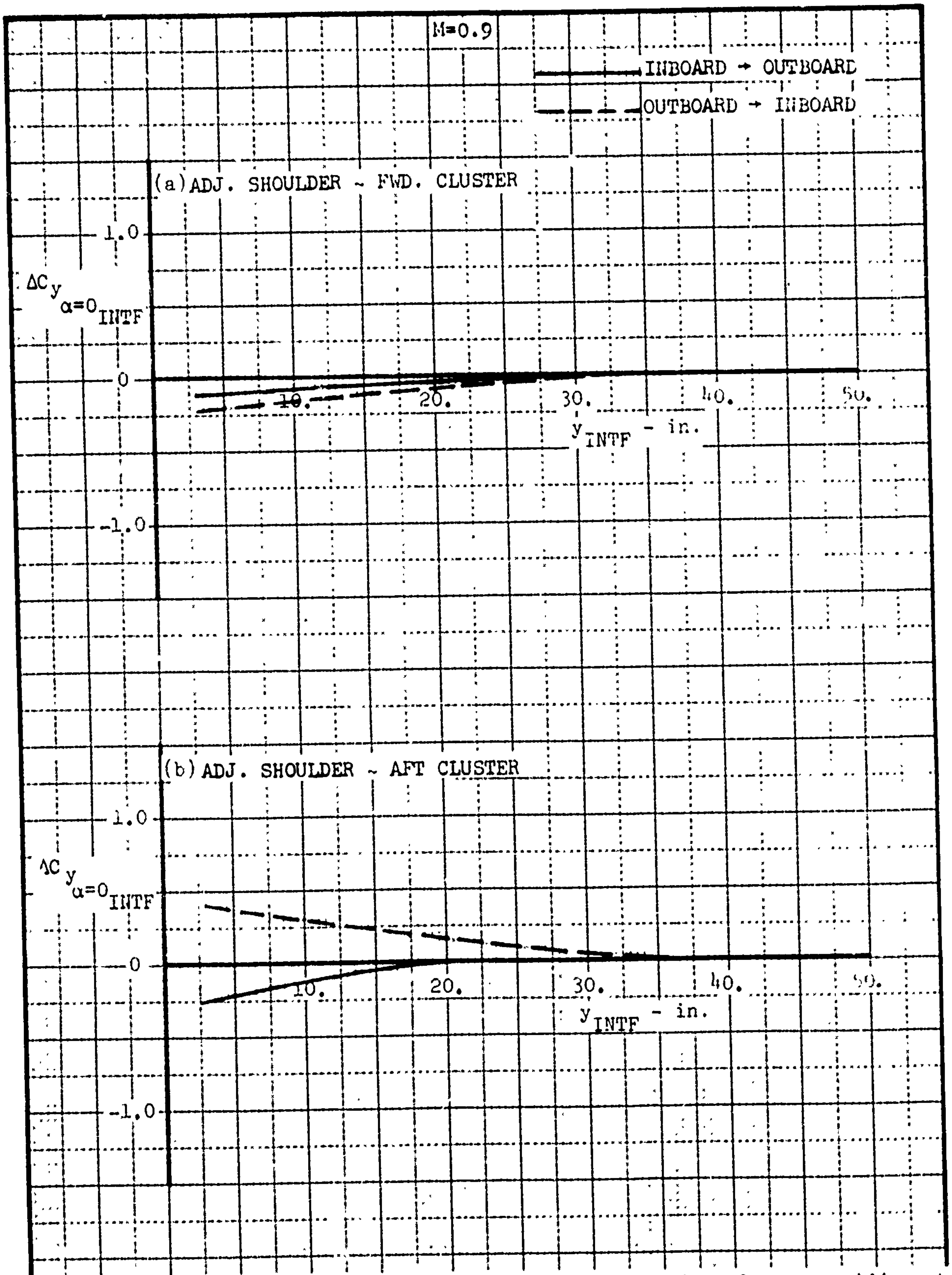



Figure 420. Incremental Side Force Intercept Due to Interference - Adjacent Shoulder at M=0.9

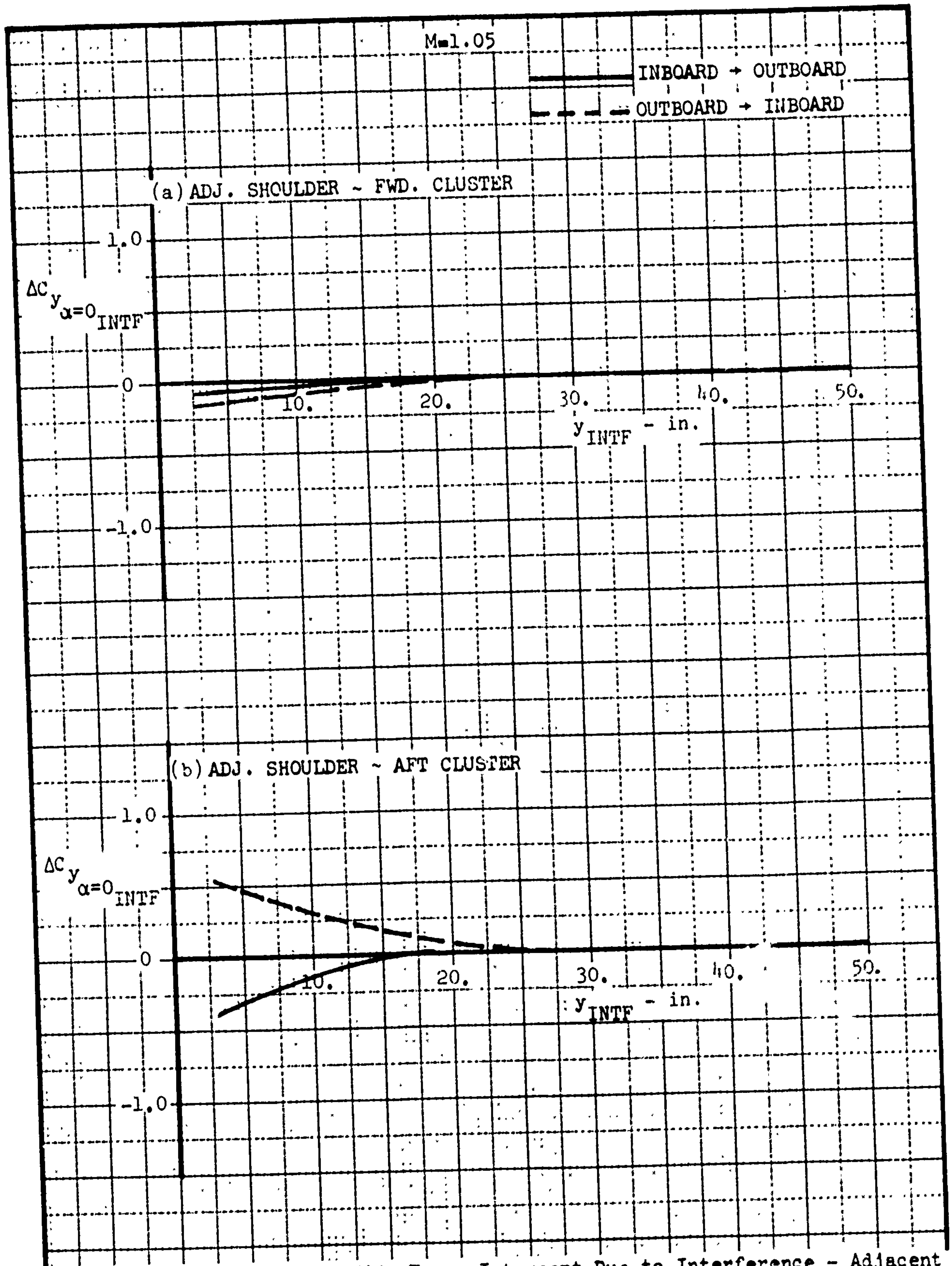



Figure 421. Incremental Side Force Intercept Due to Interference - Adjacent Shoulder at M=1.05

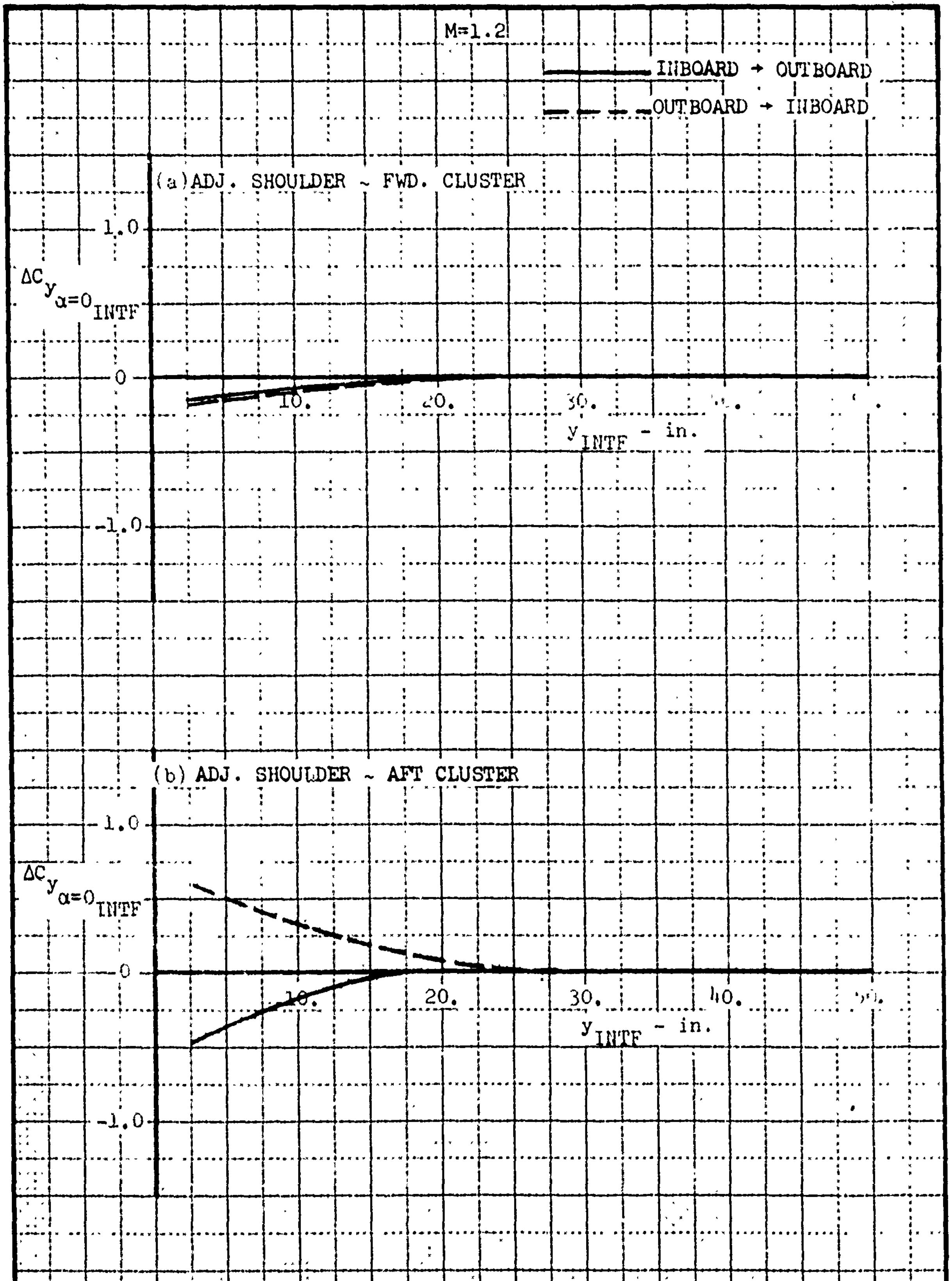



Figure 422. Incremental Side Force Intercept Due to Interference - Adjacent Shoulder at M=1.2

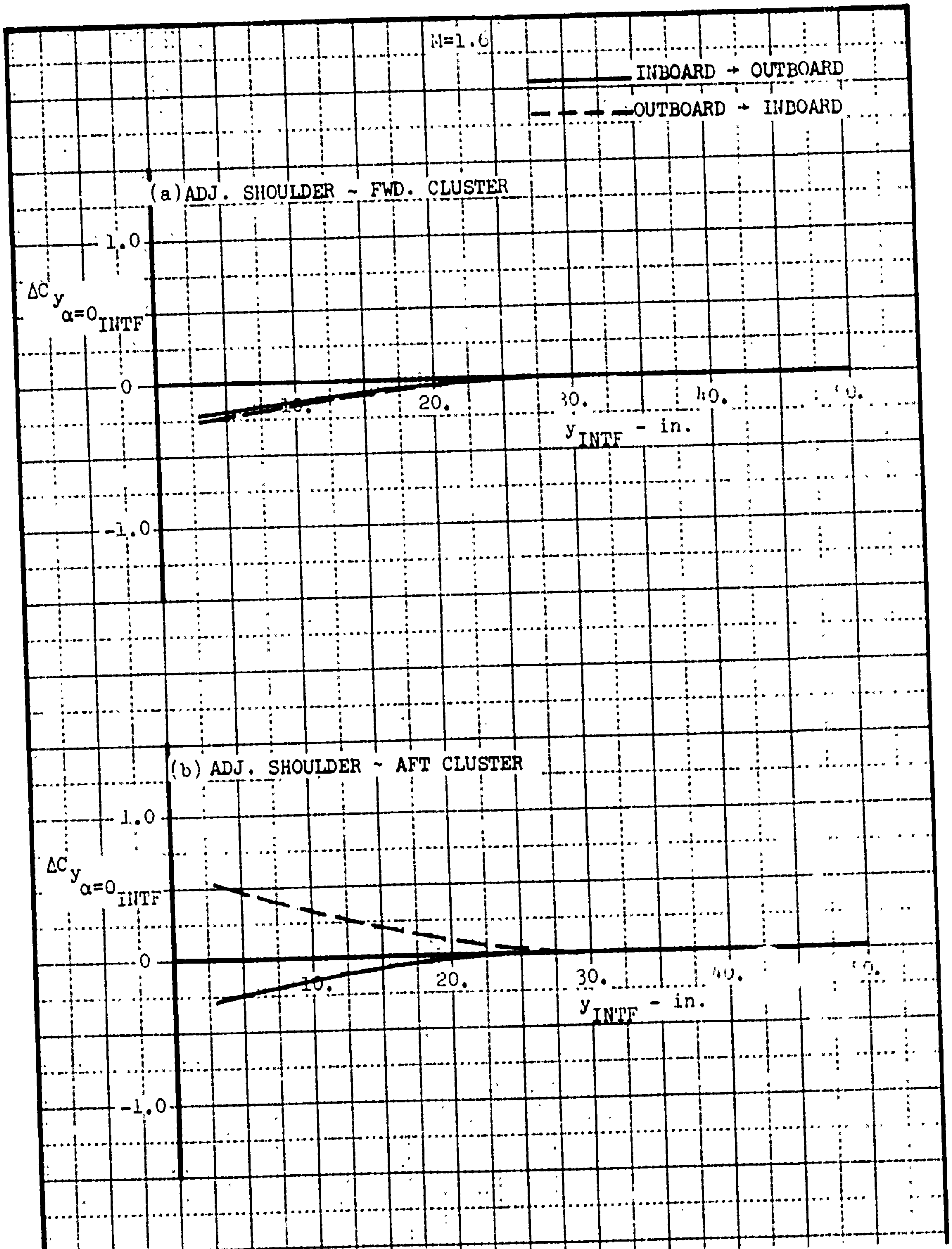



Figure 423. Incremental Side Force Intercept Due to Interference - Adjacent Shoulder at M=1.6

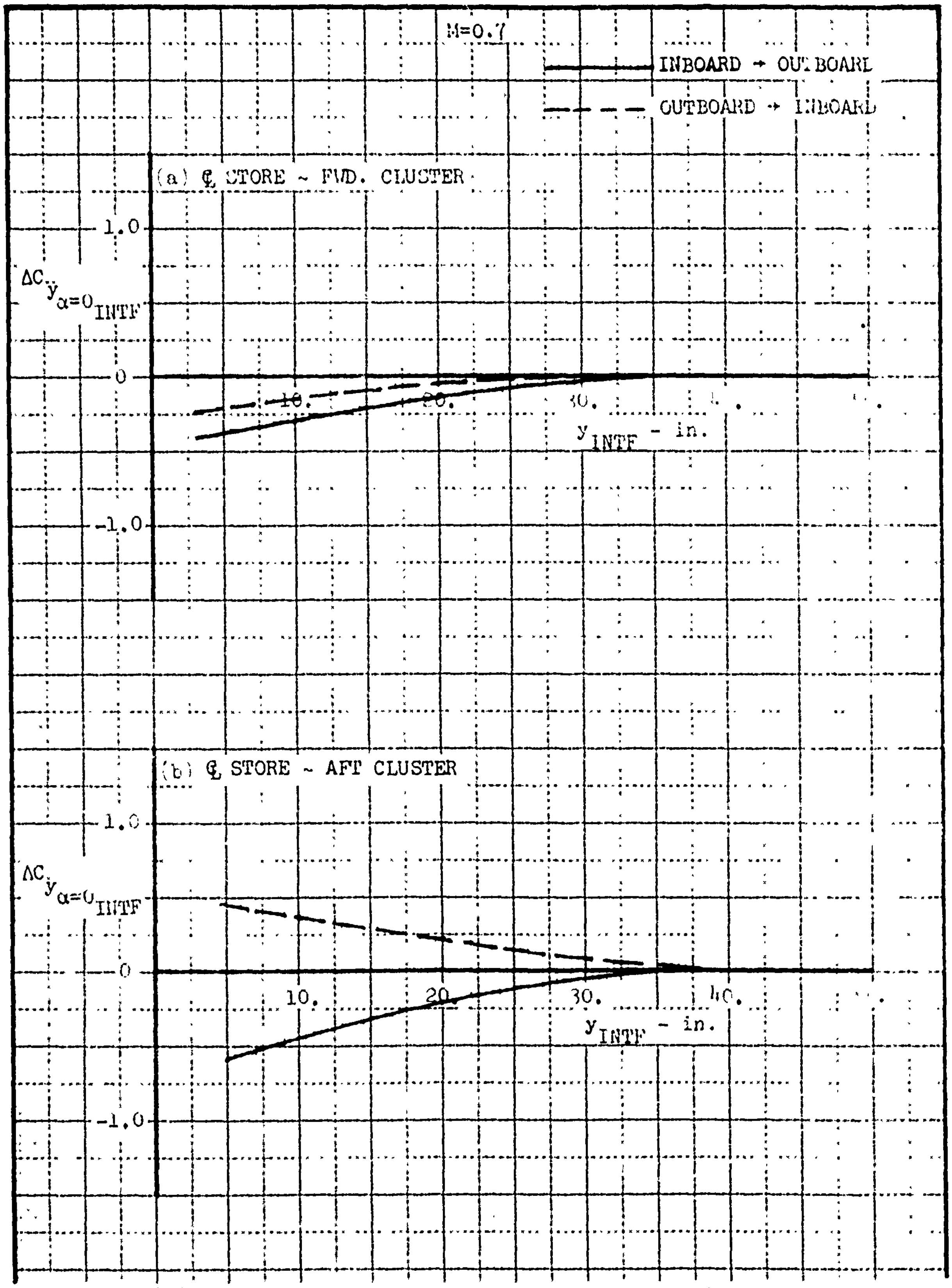



Figure 424. Incremental Side Force Intercept Due to Interference - Centerline Store at M=0.7

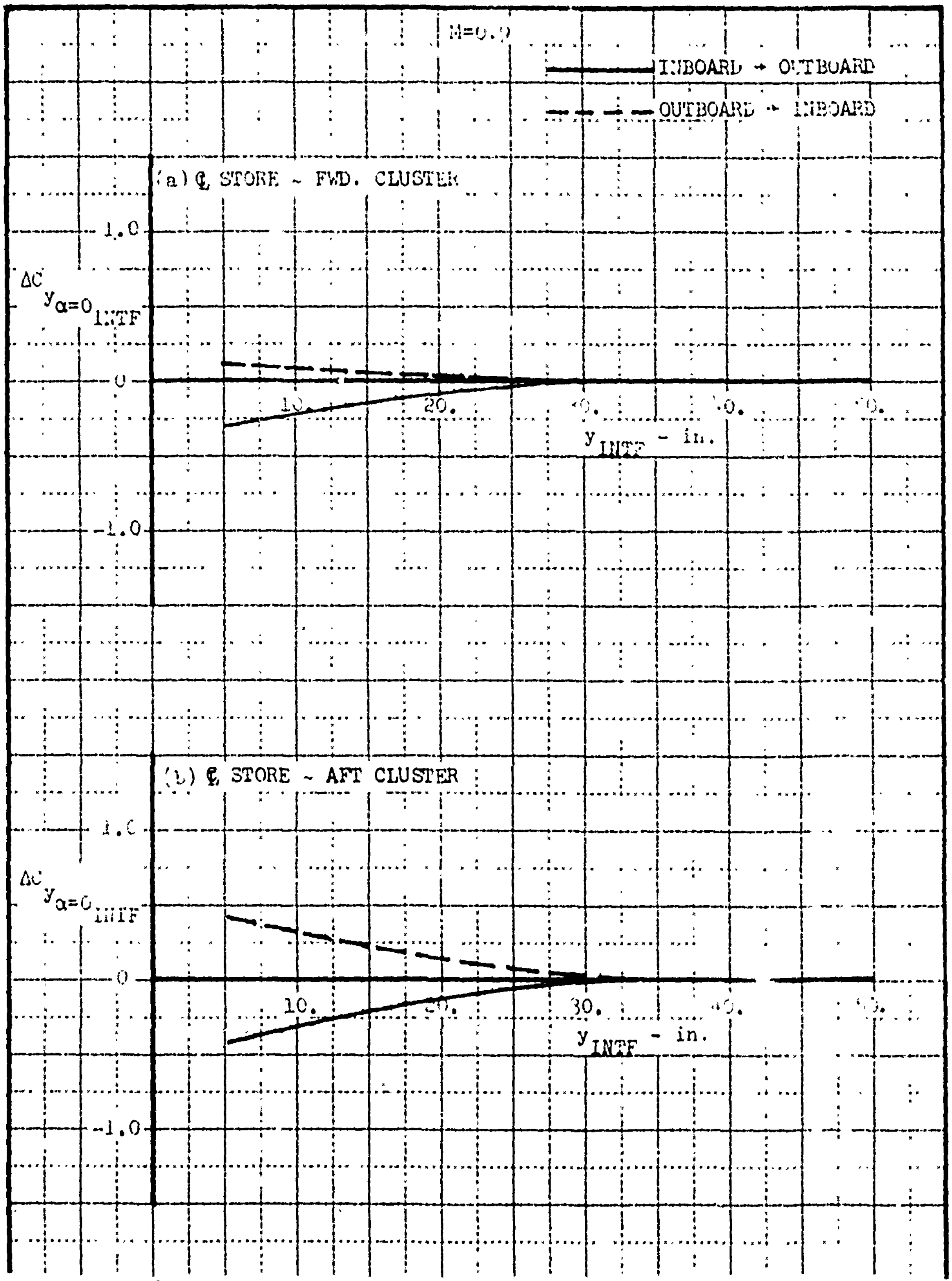



Figure 425. Incremental Side Force Intercept Due to Interference - Centerline Store at M=0.9

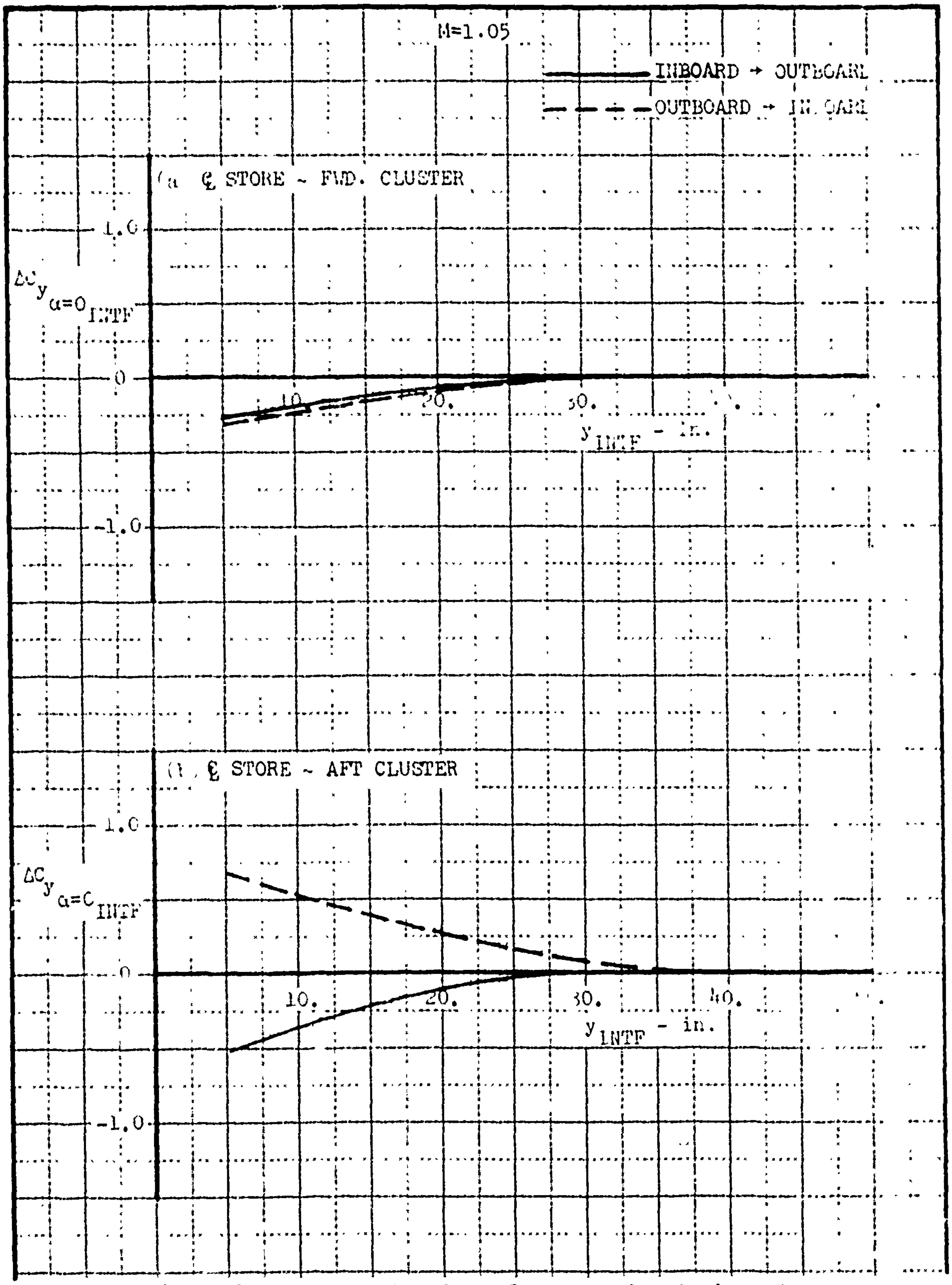



Figure 426. Incremental Side Force Intercept Due to Interference - Centerline Store at M=1.05

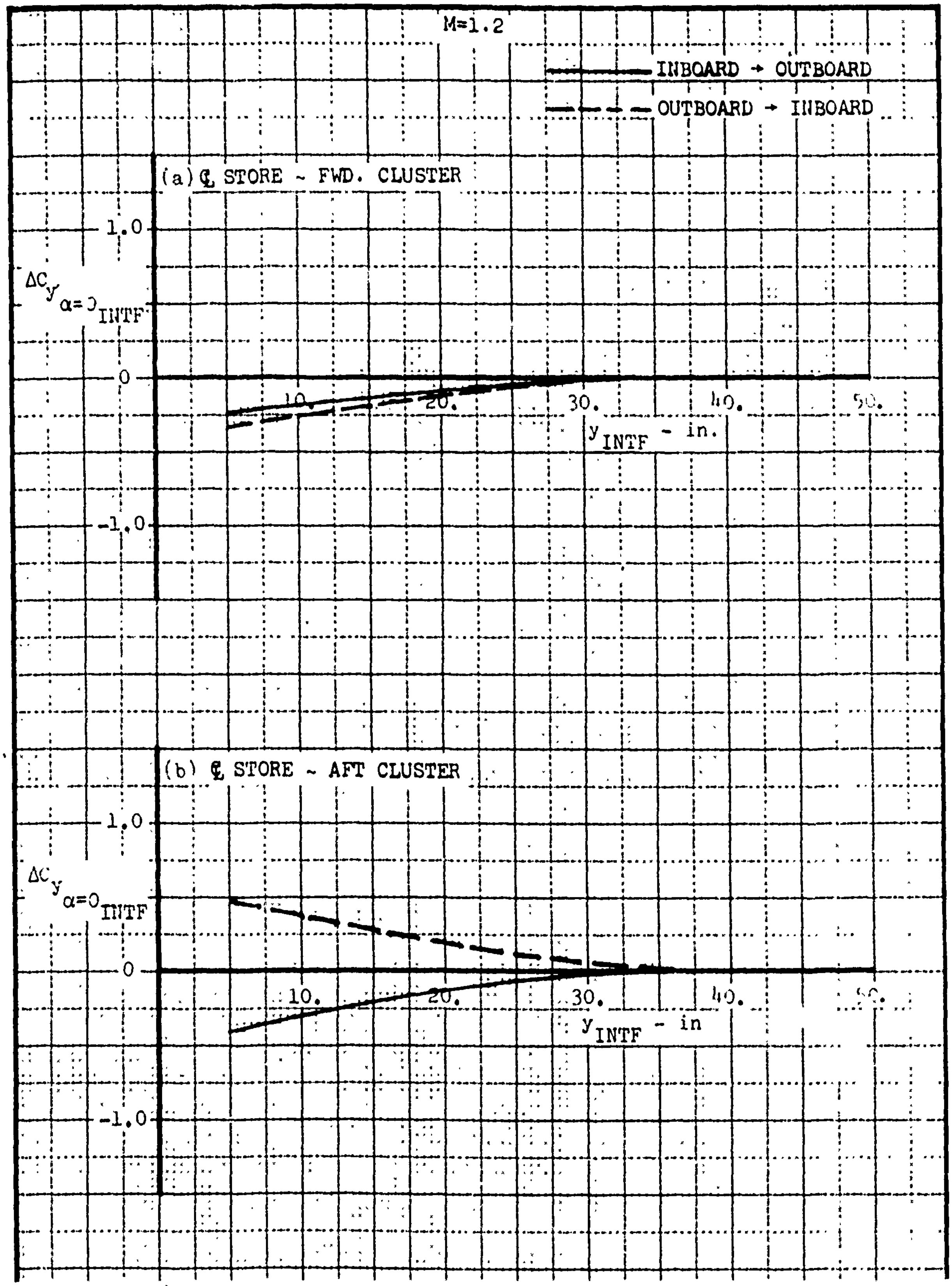



Figure 427. Incremental Side Force Intercept Due to Interference - Centerline Store at M=1.2

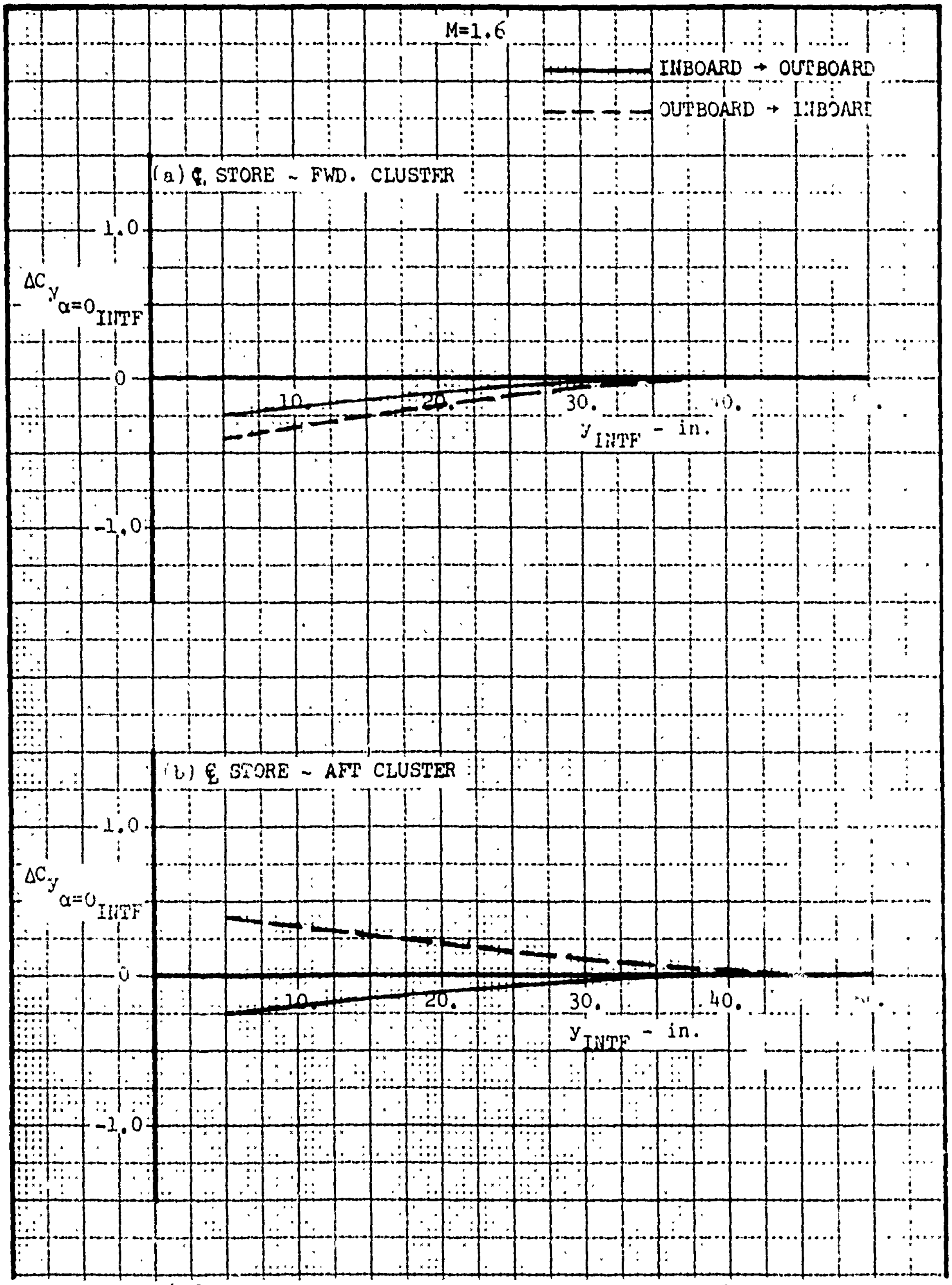



Figure 428. Incremental Side Force Intercept Due to Interference - Centerline Store at M=1.6

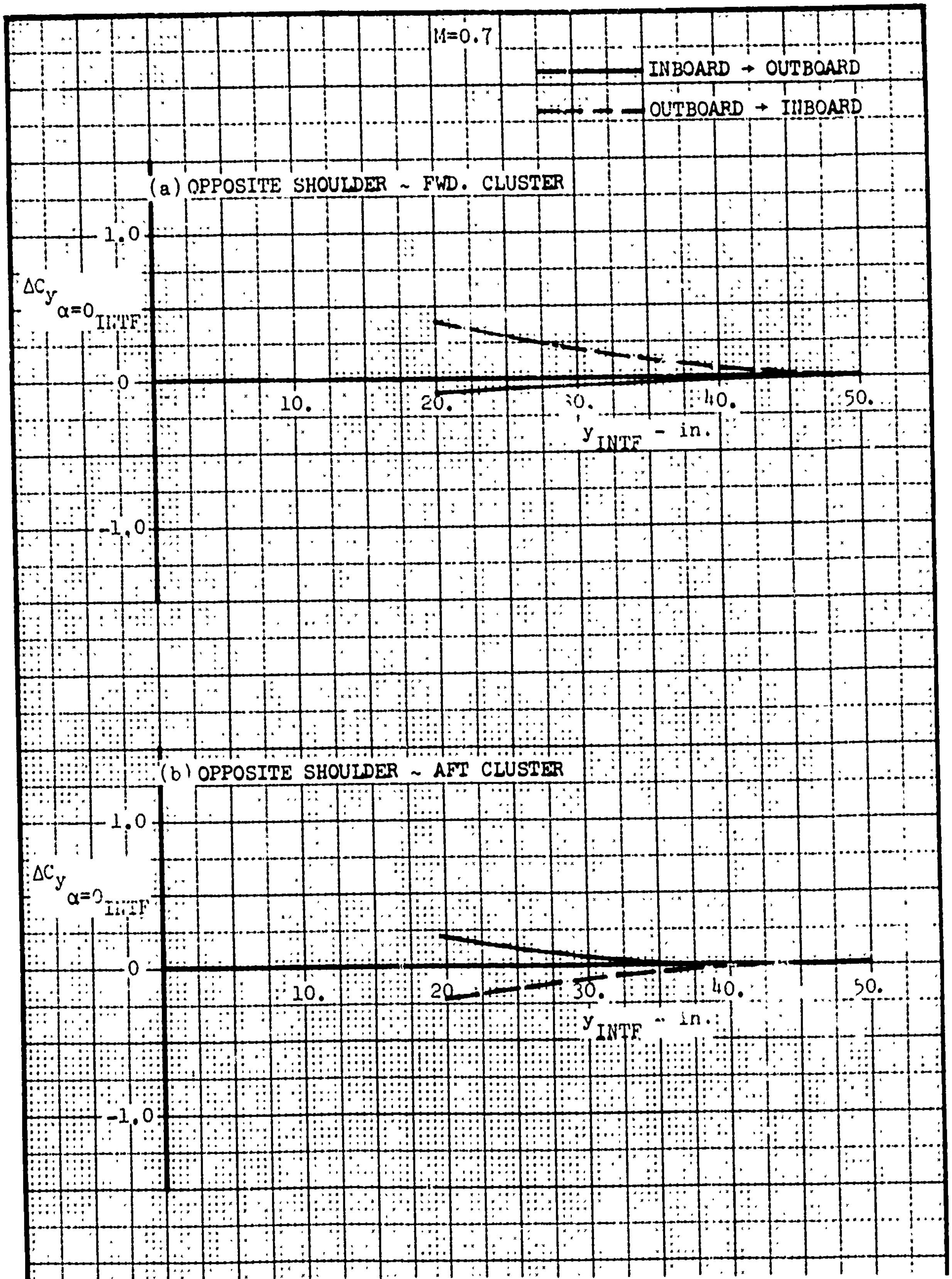



Figure 429. Incremental Side Force Intercept Due to Interference - Opposite Shoulder at M=0.7

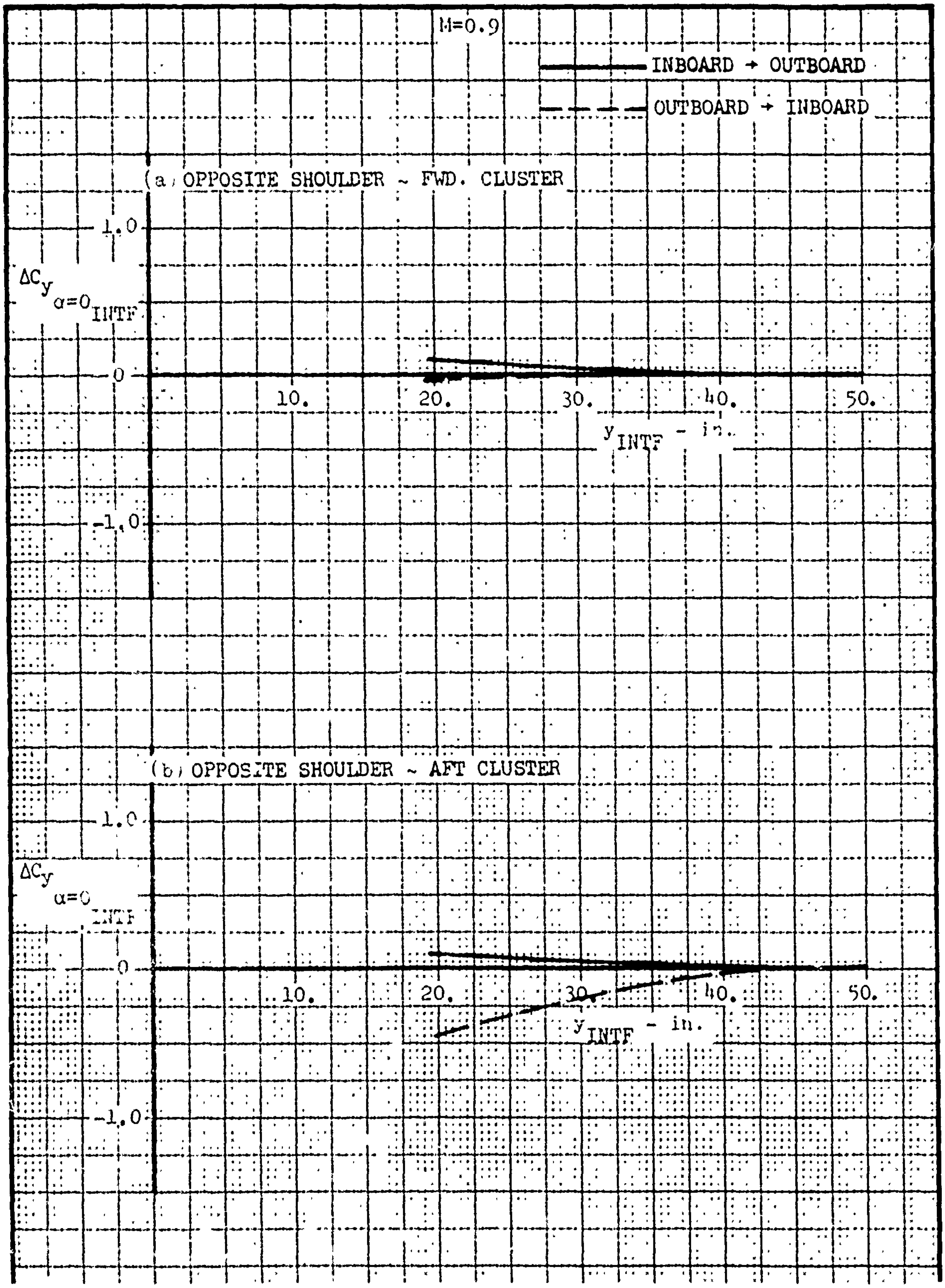



Figure 430. Incremental Side Force Intercept Due to Interference - Opposite Shoulder at M=0.9

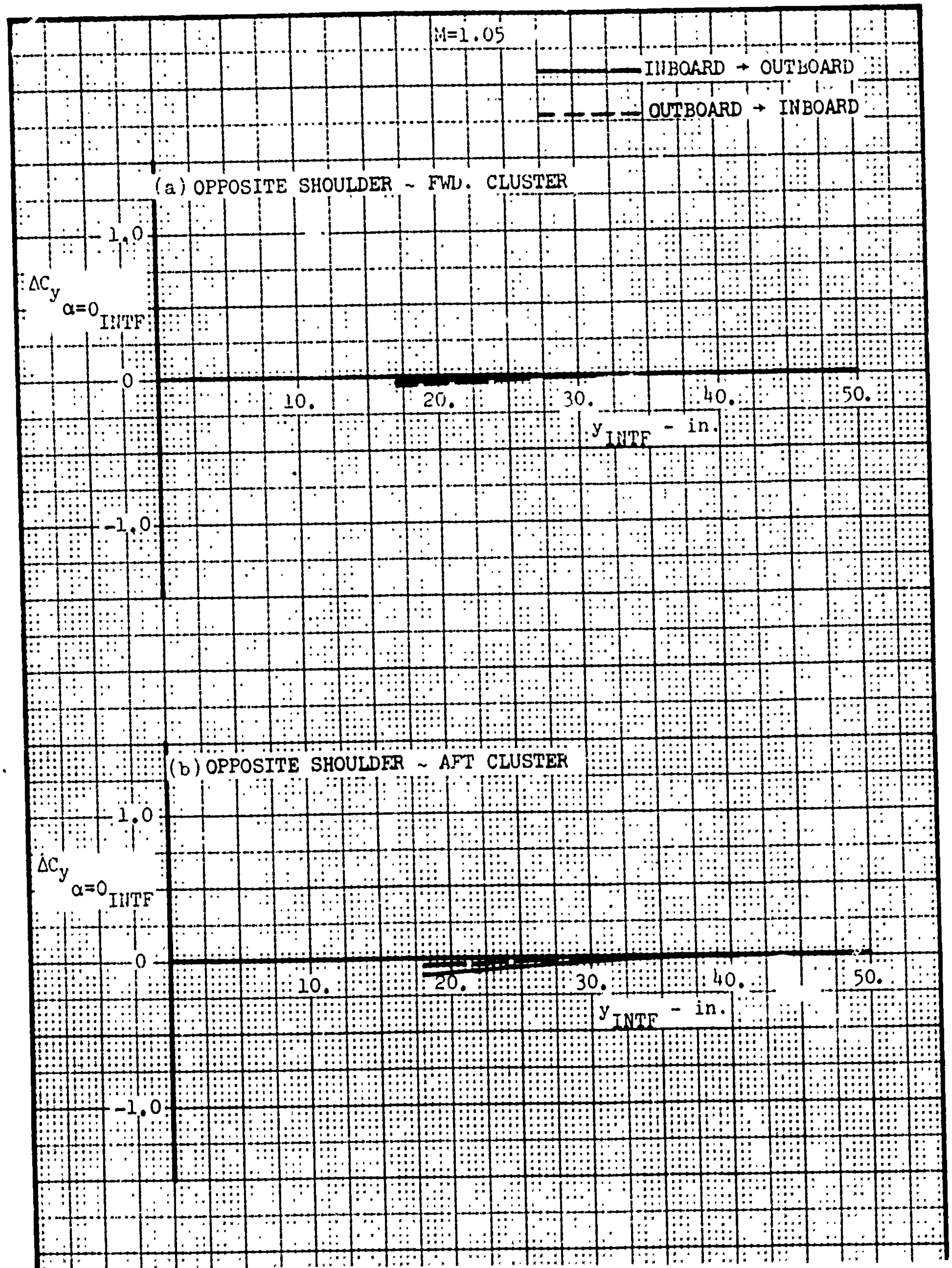



Figure 431. Incremental Side Force Intercept Due to Interference - Opposite Shoulder at M=1.05

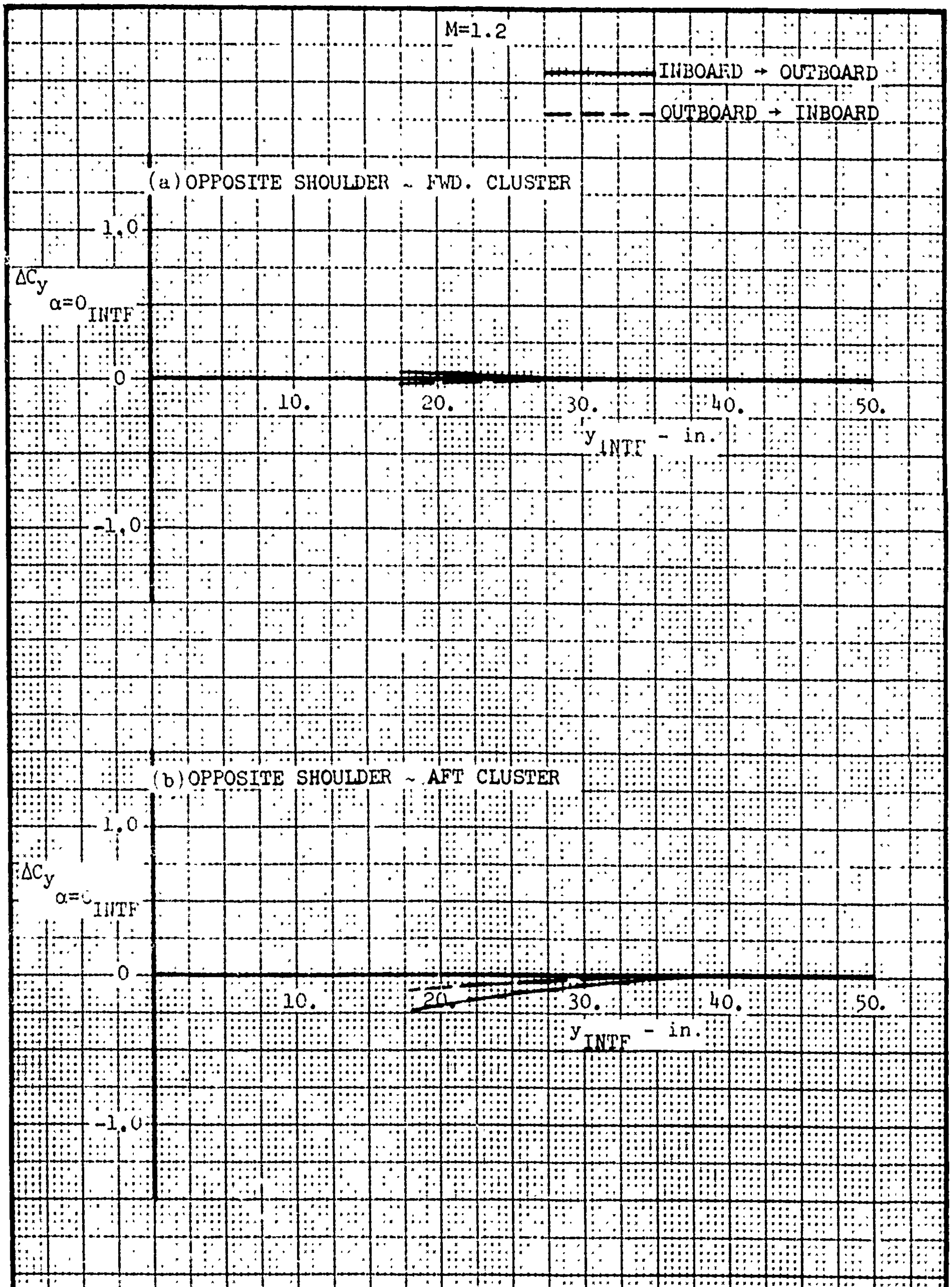



Figure 432. Incremental Side Force Intercept Due to Interference - Opposite Shoulder at M=1.2

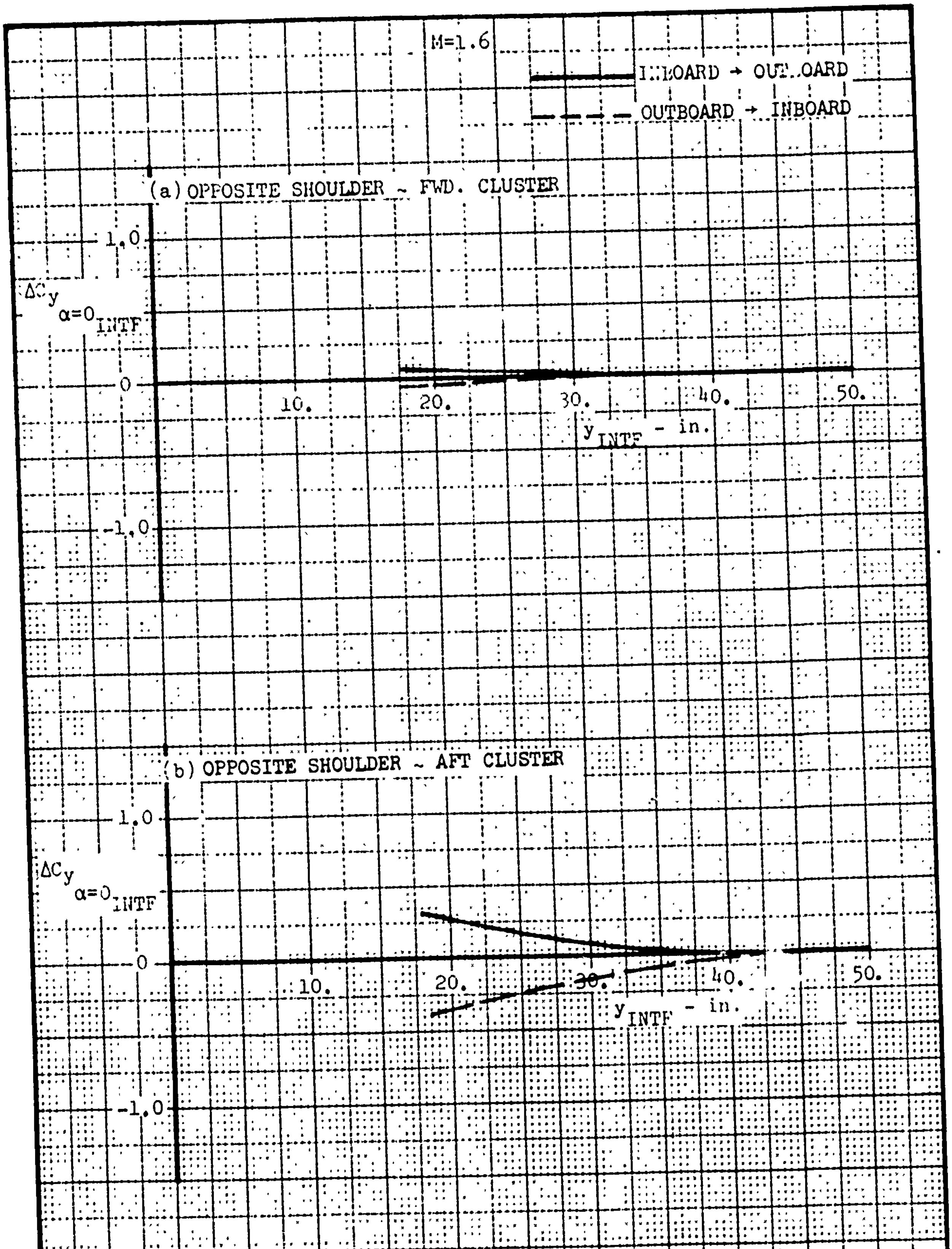



Figure 433. Incremental Side Force Intercept Due to Interference - Opposite Shoulder at M=1.6

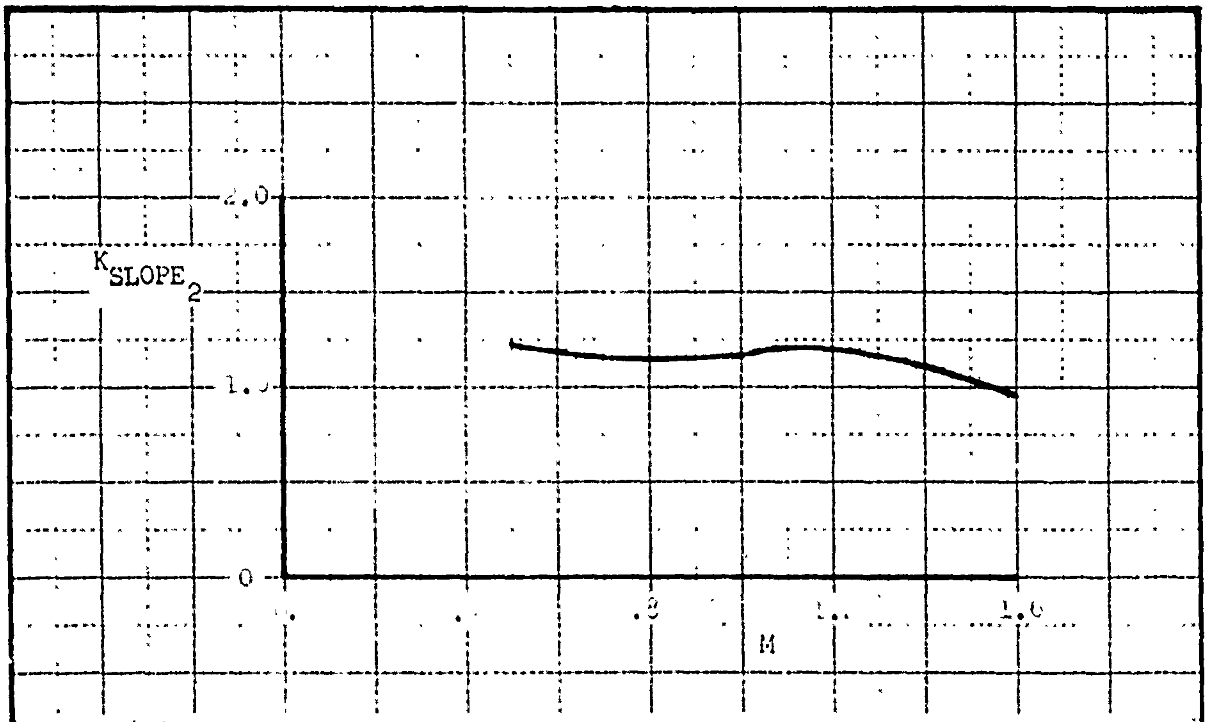



Figure 434. Incremental Side Force Intercept Due to Interference - $K_{SLOPE_2}$ for Combination Inboard and Outboard Interference

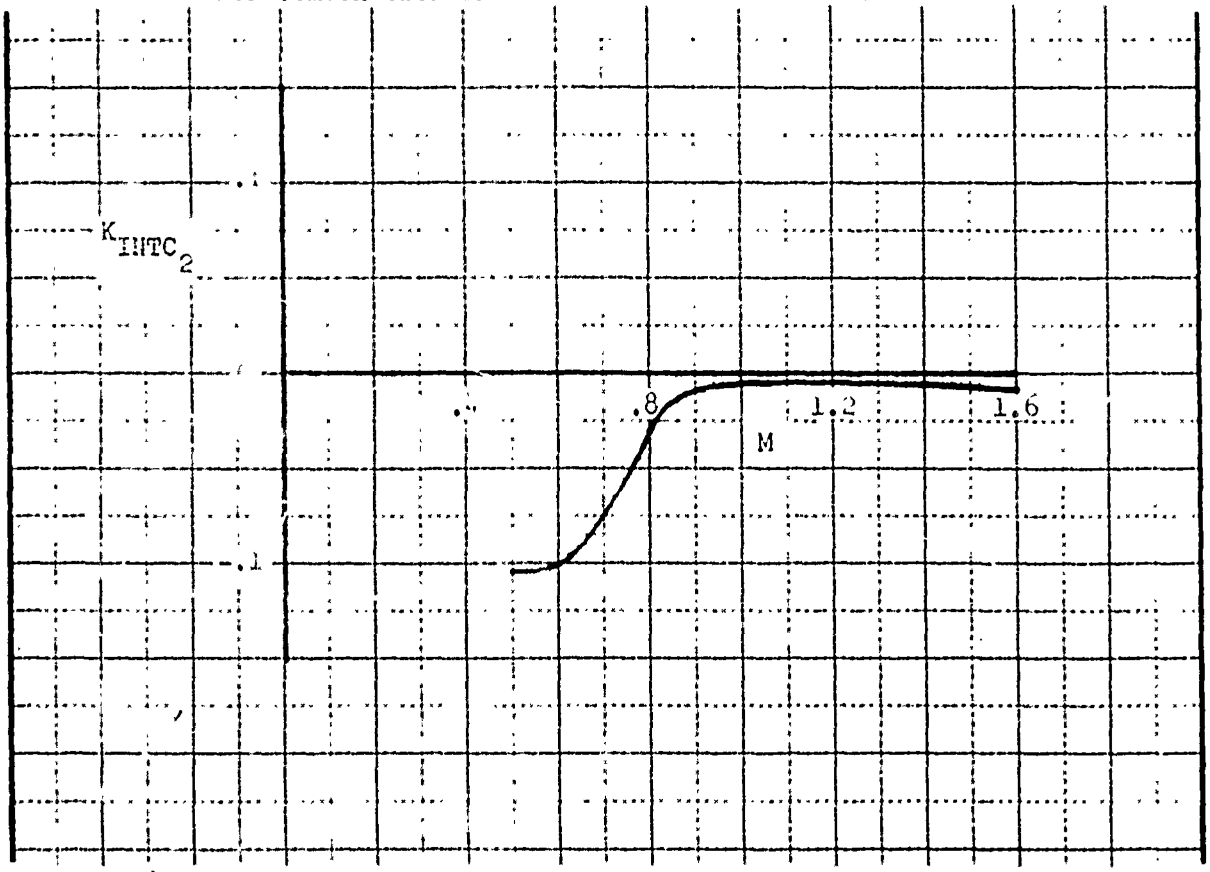



Figure 435. Incremental Side Force Intercept Due to Interference - $K_{INTC_2}$ for Combination Inboard and Outboard Interference

## 4.2 YAWING MOMENT

### 4.2.1 Basic Airload

The basic yawing moment data were generated by a zero yaw pitch excursion of the parent aircraft. The data are referenced along the store centerline at the mid-lug location of each ejector unit. Under each subsequent subsection the prediction method is separated to apply to fuselage centerline-mounted stores and to wing pylon-mounted stores.

#### 4.2.1.1 Slope Prediction

The variation of captive store yawing moment with angle of attack when the store is installed on a MER at M=0.5 is defined by the following relationships.

FUSELAGE CENTERLINE-MOUNTED STORES

MER Stations 1 and 2 (MS1,2):

$$\left(\frac{YM}{q}\right)_{\alpha_{\substack{PRED\\MS1,2}}} = 0 \quad \text{By symmetry}$$

MER Stations 3, 4, 5, and 6 (MS3-6):

$$\left(\frac{YM}{q}\right)_{\alpha_{\substack{PRED\\MS3-6}}} = S_{REF}\ \ell_{REF}\ C_{n_{\alpha_{\mathfrak{C}_{MS3-6}}}} = f(d)$$

where:

$C_{n_{\alpha_{\mathfrak{C}}}}$ - Fuselage centerline captive store yawing moment variation with angle of attack, $\frac{1}{deg}$, presented as a function of store diameter.

MER STA 3 - Figure 436

MER STA 4 - Figure 436

MER STA 5 - Figure 436

MER STA 6 - Figure 436

$S_{REF}$ - Store reference area, $\frac{\pi d^2}{4}$, ft $^2$

$\ell_{REF}$ - Store reference length, d, ft.

WING-MOUNTED STORES

MER Station 1 (MS1):

$$\left(\frac{YM}{q}\right)_{\alpha_{\substack{PRED\\MS1}}} = K_{\Lambda_1} K_{\eta_{MS1}} K_{\frac{Z}{C}_{MS1}} K_{C_{YM_{MS1}}} \left(\frac{SF}{q}\right)_{\psi_{ISO}}$$

where:

$K_{\Lambda_1}$ - Aircraft wing sweep correction factor based on the sweep angle, $\Lambda$, of the quarter-chord, $\frac{\sin \Lambda}{\sin 45^\circ}$.

$K_{\eta_{MS1}}$ - Correction factor based on semispan location, Figure 437.

$K_{\frac{Z}{C}_{MS1}}$ - Pylon height correction factor, Figure 439.

$K_{C_{YM_{MS1}}} \left(\frac{SF}{q}\right)_{\psi_{ISO}}$ - Initial pitching moment slope prediction, $\frac{ft^3}{deg}$, see Subsection 2.3.3.

MER Station 2 (MS2):

$$\left(\frac{YM}{q}\right)_{\alpha_{\substack{PRED\\MS2}}} = K_{\Lambda_1} K_{\eta_{MS2}} K_{x_{LE_F}} K_{C_{YM_{MS2}}} \left(\frac{SF}{q}\right)_{\psi_{ISO}}$$

where:

$K_{\Lambda_1}$ - Aircraft wing sweep correction factor, $\frac{\sin \Lambda}{\sin 45^\circ}$.

$K_{\eta_{MS2}}$ - Correction factor based on semispan location, Figure 437.

$K_{x_{LE_F}}$ - Correction factor based on store longitudinal location, Figure 438.

$K_{C_{YM_{MS2}}} \left(\frac{SF}{q}\right)_{\psi_{ISO}}$ - Initial pitching moment slope prediction, $\frac{ft^3}{deg}$, see Subsection 2.3.3.

MER Station 3, 4, 5, 6 (MS3-6):

$$\left(\frac{YM}{q}\right)_{\alpha_{\substack{PRED\\MS3-6}}} = K_{\Lambda_1} K_{C_{YM_{\substack{MS1\\MS2}}}} \left(\frac{SF}{q}\right)_{\psi_{ISO}} + K_{SCALE_{YM}} \Delta C_{n_{\alpha_{\substack{MS3,5\\MS4,6}}}}$$

where:

$K_{C_{YM_{\substack{MS1\\MS2}}}} \left(\frac{SF}{q}\right)_{\psi_{ISO}}$ - Initial yawing moment prediction, $\frac{ft^3}{deg}$, see Subsection 2.3.3. $K_{C_{YM}}$ to be used should be MS1 for MS3,5 and MS2 for MS4,6.

$K_{\Lambda_1}$ - Aircraft wing sweep correction factor, $\frac{\sin \Lambda}{\sin 45^\circ}$.

$K_{SCALE_{YM}}$ - Yawing moment scale factor, ft.$^3$, see Section IV.

$\Delta C_{n_\alpha}$ - Incremental yawing moment slope coefficient for the shoulder stations, $\frac{1}{deg}$.

MER STA 3 - Figure 440

MER STA 4 - Figure 441

MER STA 5 - Figure 440

MER STA 6 - Figure 441

Example: Calculate the variation of yawing moment with angle of attack for an M117 store on MER STA 6 carried on the A-7 center pylon at M=0.5.

Required for Computation:

$C_{LOCAL}$ = 127.6 in.

$K_{\Lambda_1} = \frac{\sin 35^\circ}{\sin 45^\circ} = .811$

$\left(\frac{SF}{q}\right)_{\psi_{ISO}} = .114 \text{ ft}^2$

SPA = 1200 in $^2$

$$K_{SCALE_{YM}} = \frac{\left(\frac{SF}{q}\right)_{\psi_{ISO}}^{SPA}}{71.4} = \frac{(.114)(1200)}{71.4} = 1.92 \text{ ft}^3$$

$$K_{C_{YM}\atop MS2} \left(\frac{SF}{q}\right)_{\psi_{ISO}} = -.088 \frac{\text{ft}^3}{\text{deg}}, \text{ Subsection 2.3.3}$$

$$\Delta C_{n_{\alpha}\atop MS6} = -.011 \frac{1}{\text{deg}}, \text{ Figure 441}$$

$$\left(\frac{YM}{q}\right)_{\alpha_{PRED \atop MS6}} = (.811)(-.088) + (1.92)(-.011) = -.092 \frac{\text{ft}^3}{\text{deg}}$$

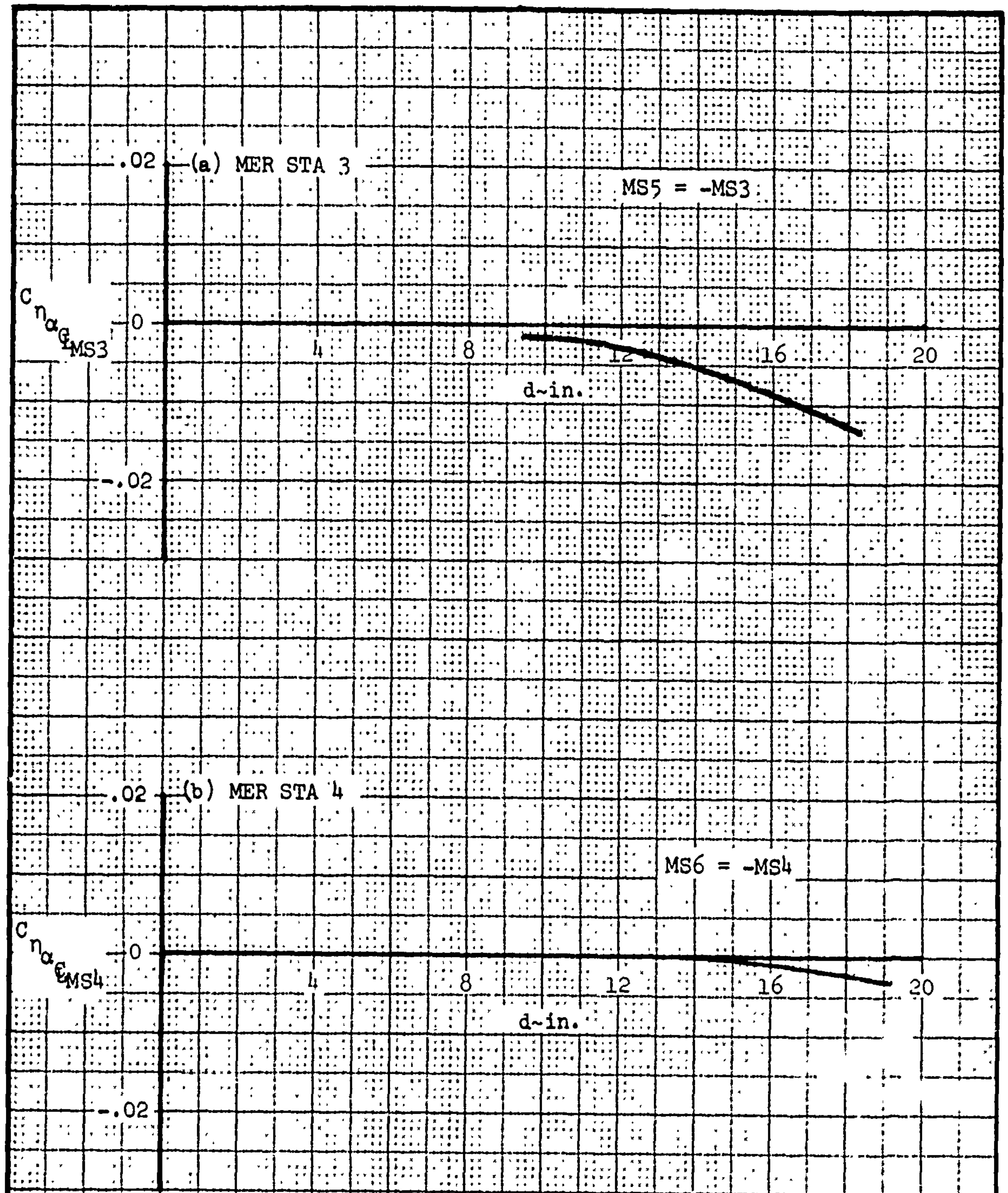



Figure 436. Yawing Moment Slope - Stores Mounted on Fuselage Centerline, MER Stations 3-6

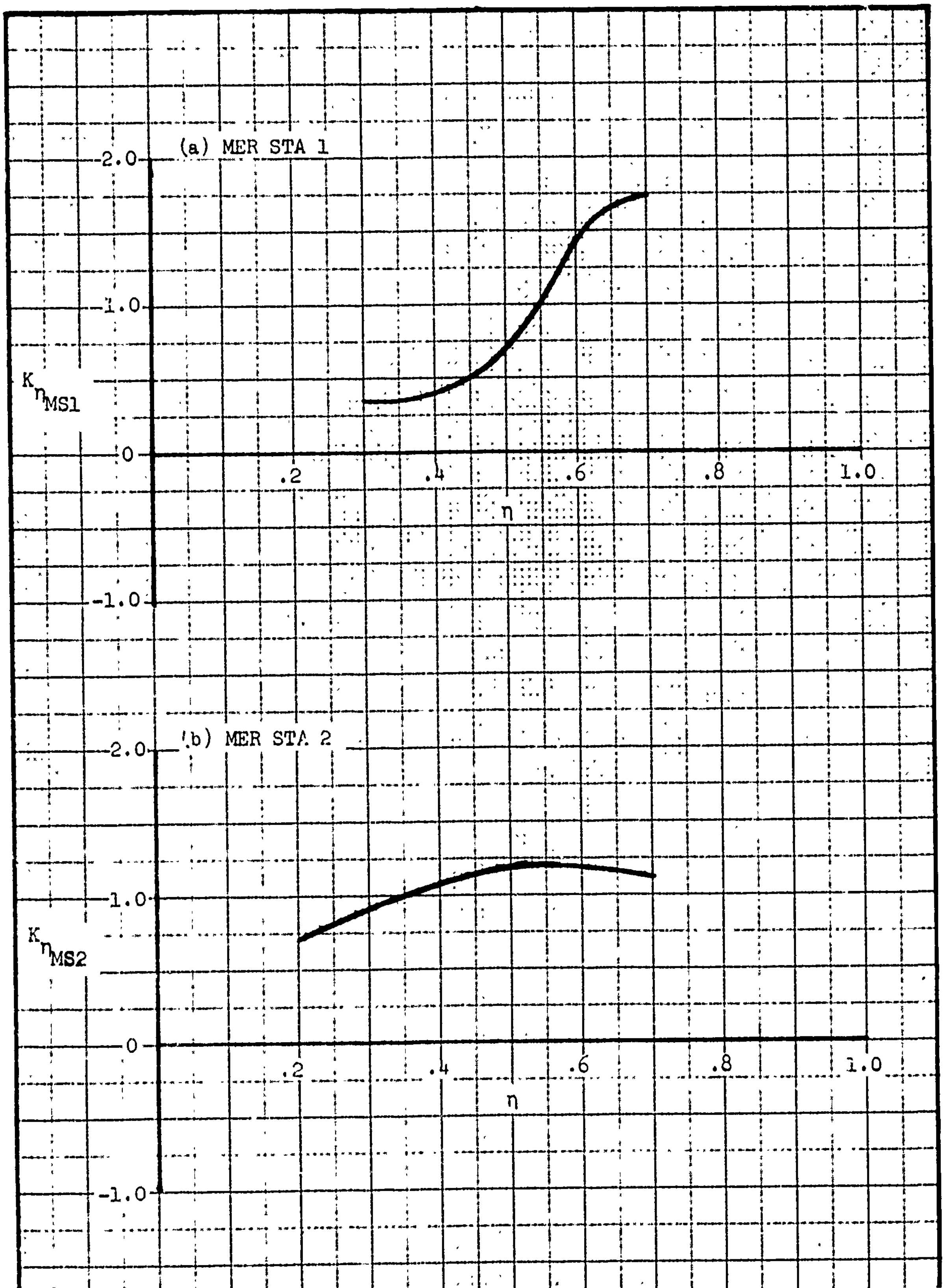



Figure 437. Yawing Moment Slope - Spanwise Correction for MER Stations 1 and 2

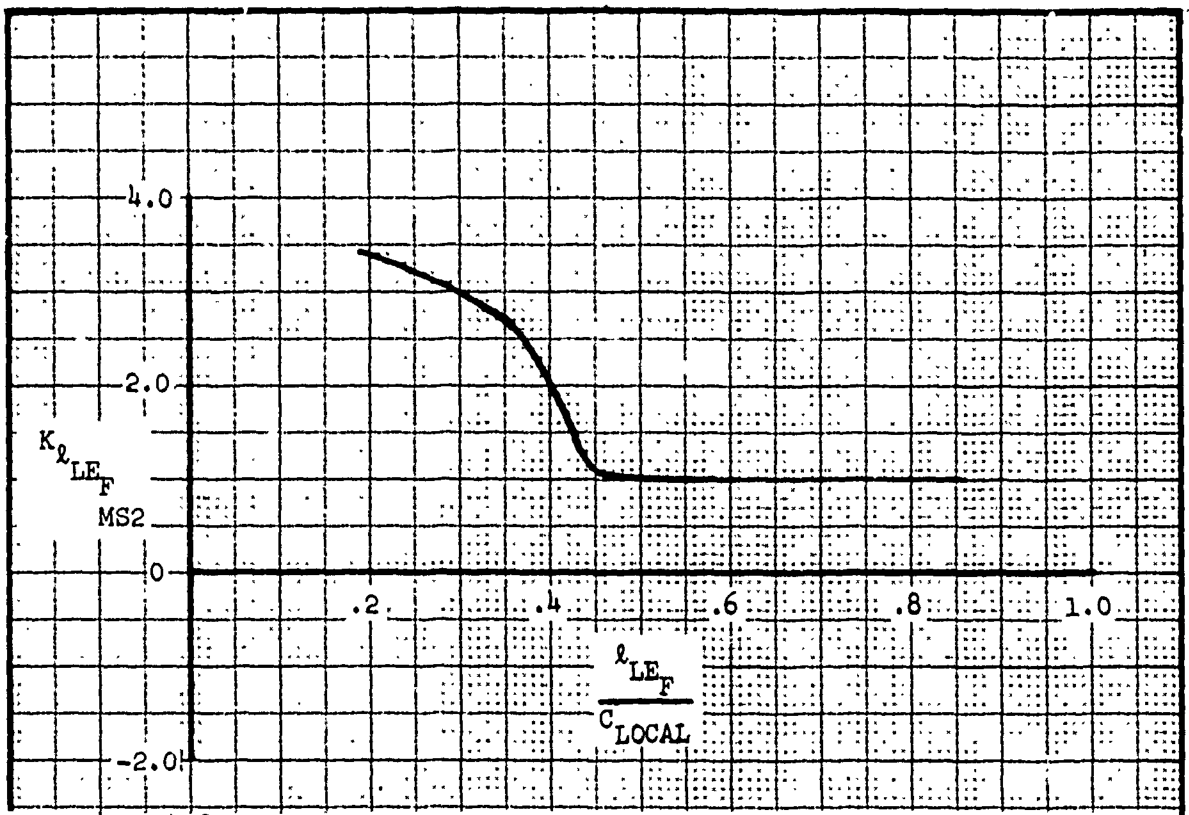



Figure 438. Yawing Moment Slope - Chordwise Position Correction for MER Station 2

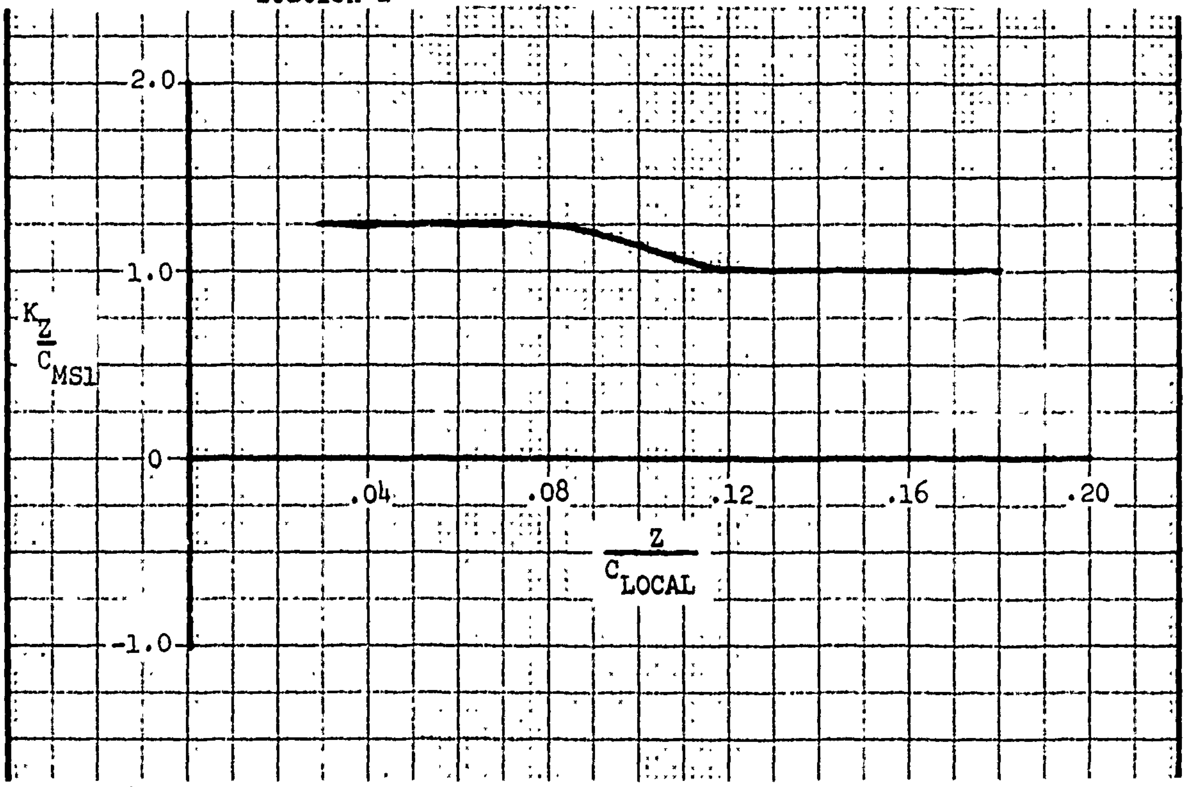



Figure 439. Yawing Moment Slope - Pylon Height Correction for MER Station 1

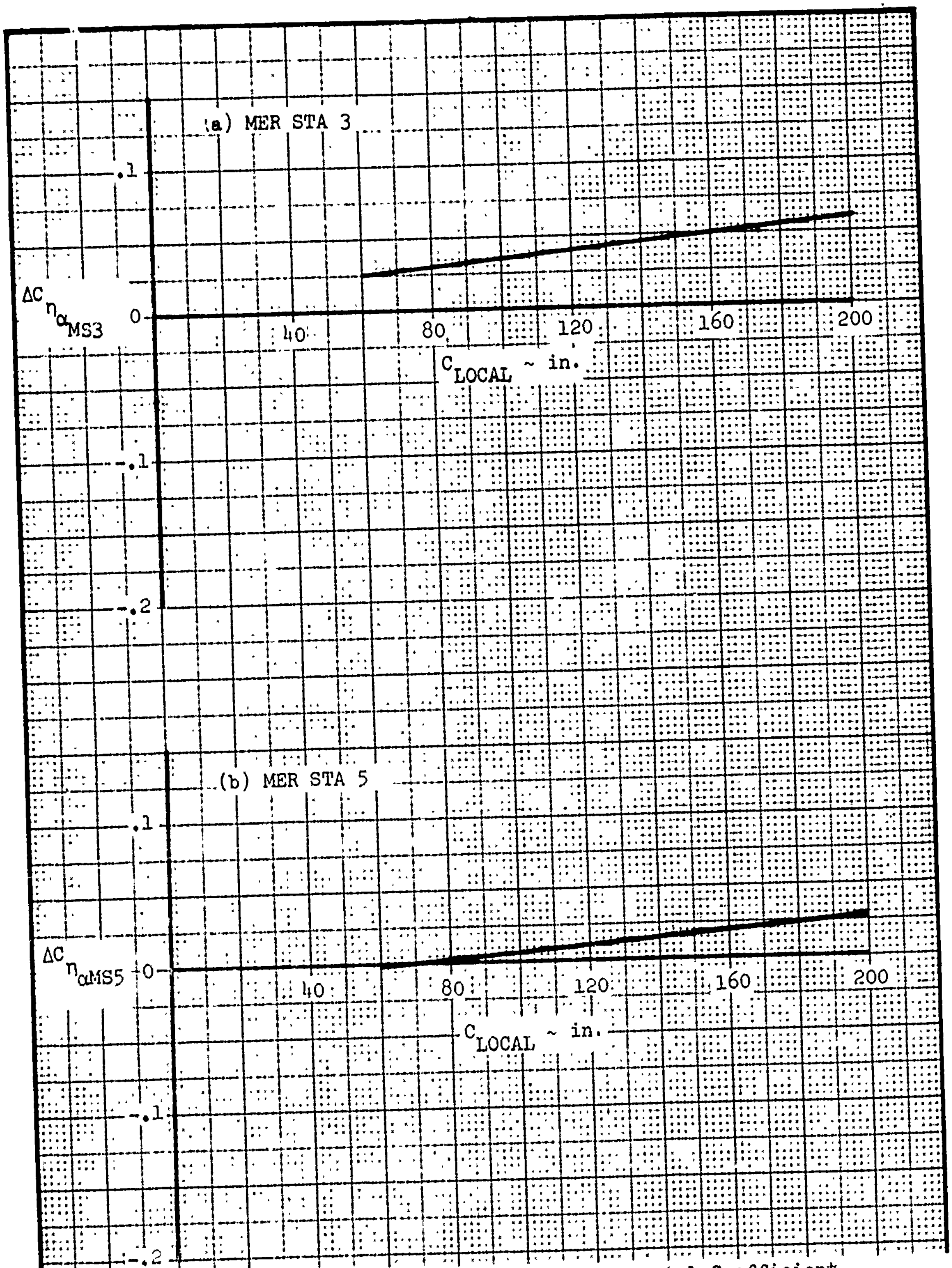



Figure 440. Yawing Moment Slope - Incremental Coefficient for Wing Mounted Stores, MER Stations 3 and 5

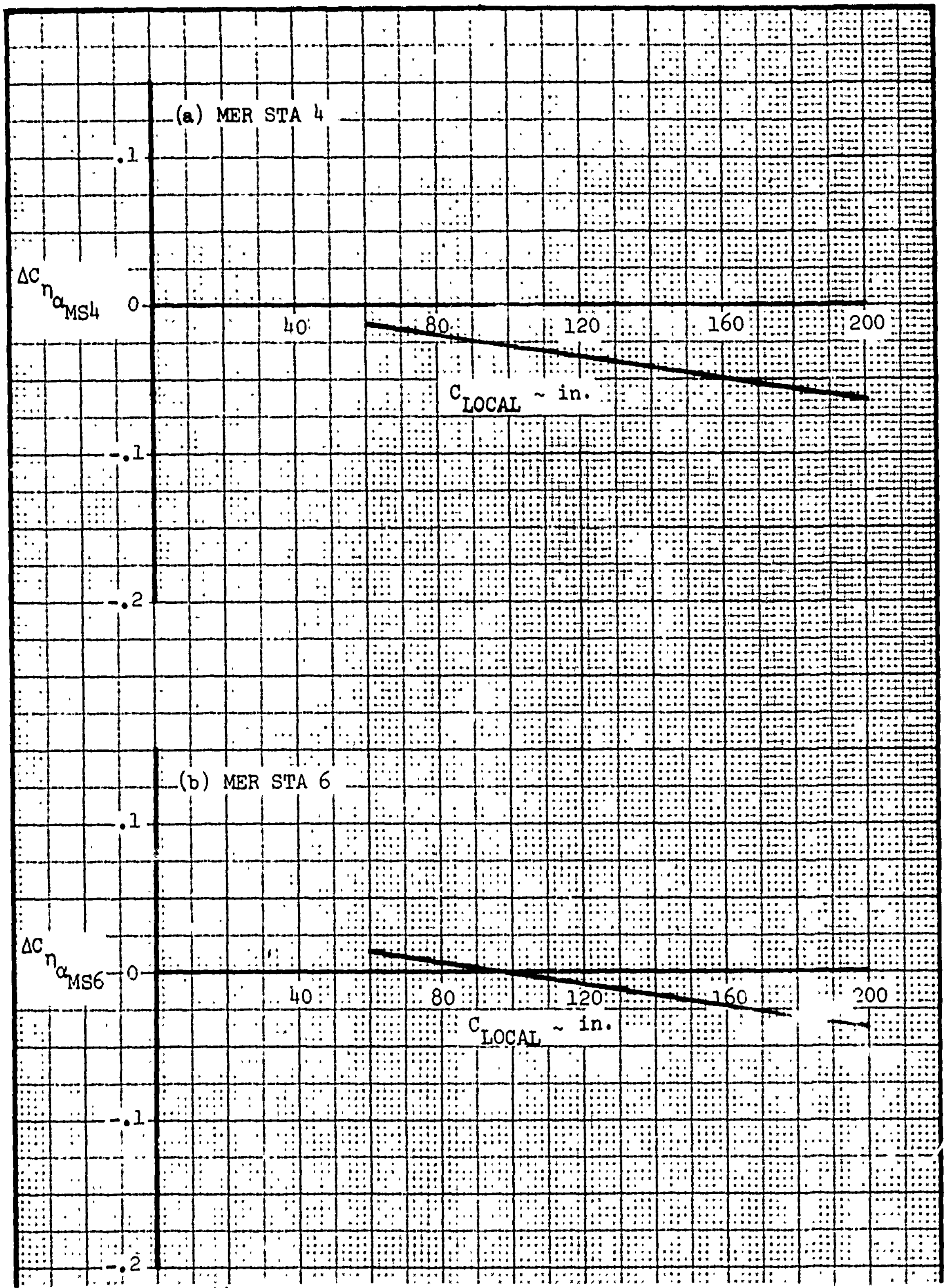



Figure 441. Yawing Moment Slope - Incremental Coefficient for Wing Mounted Stores, MER Stations 4 and 6

### 4.2.1.2 Slope Mach Number Correction

To compute the variation in captive store yawing moment slope with angle of attack, $\left(\frac{YM}{q}\right)_\alpha$, between M=0.5 and M=1.6, use the following expression.

$$\left(\frac{YM}{q}\right)_{\alpha_{M=x}} = \left(\frac{YM}{q}\right)_{\alpha_{PRED}} + \Delta\left(\frac{YM}{q}\right)_{\alpha_{M=x}}$$

where:

$\Delta\left(\frac{YM}{q}\right)_{\alpha_{M=x}}$ - Increment in yawing moment slope at M=x, $\frac{ft^3}{deg}$ .

$\left(\frac{YM}{q}\right)_{\alpha_{PRED}}$ - Predicted yawing moment slope at M=0.5, Subsection 4.2.1.1, $\frac{ft^3}{deg}$

FUSELAGE CENTERLINE-MOUNTED STORES

MER Stations 1 and 2 (MS1,2):

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{M=x,\ MS1,2}} = 0 \quad \text{by symmetry}$$

MER Stations 3, 4, 5 and 6 (MS3-6):

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{M=x,\ MS3-6}} = K_{SCALE_{YM}} \Delta C_{n_{\alpha_{\mathbb{C}_L\ MS3-6}}} = f(M)$$

where:

$\Delta C_{n_{\alpha_{\mathbb{C}_L\ MS3-6}}}$ - Incremental yawing moment slope coefficient as a function of Mach number, $\frac{1}{deg}$ .

MER STA 3 - Figure 442

MER STA 4 - Figure 442

MER STA 5 - Figure 442

MER STA 6 - Figure 442

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

WING-MOUNTED STORES

The generalized curve of the variation of $\left(\frac{YM}{q}\right)_\alpha$ with Mach number is given by Figure 61 in Subsection 3.2.1.2. The variation of yawing moment slope with Mach number is approximated by a series of linear segments. Each Mach number at which the line segments change slope is designated a break point. The initial break point, $M_o$, is defined as the Mach number at which the value of $\left(\frac{YM}{q}\right)_\alpha$ deviates from the subsonic M=0.5 value. The variation of the Mach break points ($M_o$, $M_1$, $M_2$, $M_3$) is presented in Figures 443 through 445 as a function of $C_{LOCAL}$ and/or $K_{\Lambda_1}$. The variation of $C_{n_\alpha}$ with Mach number between break points for each MER station is presented in Figures 446 through 454. The expressions below define the calculation procedures for each MER Station over the applicable Mach range.

Break 1 ($M_1$): $M_o \leq x \leq M_1$

MER Station 1, 2, 3, 4, 5 and 6 (MS1-6):

$$\Delta\left(\frac{YM}{q}\right)_{\alpha\,\substack{M=x\\ MS1-6}} = \left[\left(x-M_o\right) K_{SLOPE_1\,MS1-6}\right] K_{SCALE_{YM}}$$

where:

$K_{SLOPE_1}$ - The variation of $C_{n_\alpha}$ with Mach number between $M_o$ and $M_1$, $\frac{1}{deg.}$

MER STA 1 - Figure 446

MER STA 2 - Figure 446

MER STA 3 - Figure 447

MER STA 4 - Figure 448

MER STA 5 - Figure 447

MER STA 6 - Figure 448

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

Break 2 ($M_2$): $M_1 \leq x \leq M_2$

MER Station 1, 2, 3, 4, 5 and 6 (MS1-6):

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{\substack{M=x\\MS1-6}}} = \left[\left(M_1-M_o\right) K_{SLOPE_{1_{MS1-6}}} + \left(x-M_1\right) K_{SLOPE_{2_{MS1-6}}}\right] \cdot \left(K_{SCALE_{YM}}\right)$$

$K_{SLOPE_1}$ - Defined under Break 1.

$K_{SLOPE_2}$ - The variation of $C_{n_\alpha}$ with Mach number between $M_1$ and $M_2$, $\frac{1}{deg}$.

MER STA 1 - Figure 449

MER STA 2 - Figure 449

MER STA 3 - Figure 450

MER STA 4 - Figure 451

MER STA 5 - Figure 450

MER STA 6 - Figure 451

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

Break 3 ($M_3$): $M_2 \leq x \leq M_3$

MER Station 4 has only two break points between M=0.5 and M=1.6

MER Stations 2 and 6 (MS2,6):

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{\substack{M=x\\MS2,6}}} = \left[\left(M_1-M_o\right) K_{SLOPE_{1_{MS2,6}}} + \left(M_2-M_1\right) K_{SLOPE_{2_{MS2,6}}} + \left(x-M_2\right) K_{SLOPE_{3_{MS2,6}}}\right] K_{SCALE_{YM}}$$

where:

$K_{SLOPE_1}$ - Defined under Break 1

$K_{SLOPE_2}$ - Defined under Break 2

$K_{SLOPE_3}$ - The variation of $C_{n_\alpha}$ with Mach number between $M_2$ and $M_3$, $\frac{1}{deg}$.

MER STA 2 - Figure 452

MER STA 6 - Figure 454

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

MER Stations 1, 3 and 5 (MS1,3,5) :

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{\substack{M=x\\MS1,3,5}}} = \left[\left(M_1-M_o\right) K_{SLOPE_{1_{MS1,3,5}}} + \left(M_2-M_1\right) K_{SLOPE_{2_{MS1,3,5}}} + \left(x-M_2\right)\left(K_{SLOPE_{3_{MS1,3,5}}} + \Delta K_{SLOPE_{3_{\substack{AFT\\MS1,3,5}}}}\right)\right] K_{SCALE_{YM}}$$

where:

$K_{SLOPE_1}$ - Defined under Break 1.

$K_{SLOPE_2}$ - Defined under Break 2.

$K_{SLOPE_3}$ - The variation of $C_{n_\alpha}$ with Mach number between $M_2$ and $M_3$, $\frac{1}{deg}$ .

MER STA 1 - Figure 452

MER STA 3 - Figure 453

MER STA 5 - Figure 453

$\Delta K_{SLOPE_{3_{AFT}}}$ - Increment to $K_{SLOPE_3}$ for the aft cluster based on $\eta'$, $\frac{1}{deg}$ , Figure 455.

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

Example:

Compute $\left(\frac{YM}{q}\right)_\alpha$ for an M117 carried on MER Station 6 on the A-7 center pylon at M=0.8.

Required for Computation:

$C_{LOCAL}$ = 127.6 in.

$$K_{\Lambda_1} = \frac{\sin 35^\circ}{\sin 45^\circ} = .811$$

$K_{SCALE_{YM}}$ = 1.92 ft.$^3$ - Subsection 4.2.1.1

$M_{0_{MS6}}$ = 0.5 - Figure 444

$M_{1_{MS6}}$ = 0.9 - Figure 444

$K_{SLOPE_{1_{MS6}}} = -.057 \frac{1}{\text{deg}}$ - Figure 448

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{\substack{M=.8\\MS6}}} = \left[\left(0.8-0.5\right)\left(-.057\right)\right] 1.92 = -.033 \frac{ft^3}{deg}.$$

$\left(\frac{YM}{q}\right)_{\alpha_{\substack{PRED\\MS6}}} = -.092 \frac{ft.^3}{deg.}$ - Subsection 4.2.1.1

$$\left(\frac{YM}{q}\right)_{\alpha_{\substack{M=.8\\MS6}}} = -.092 - .033 = -.125 \frac{ft^3}{deg}.$$

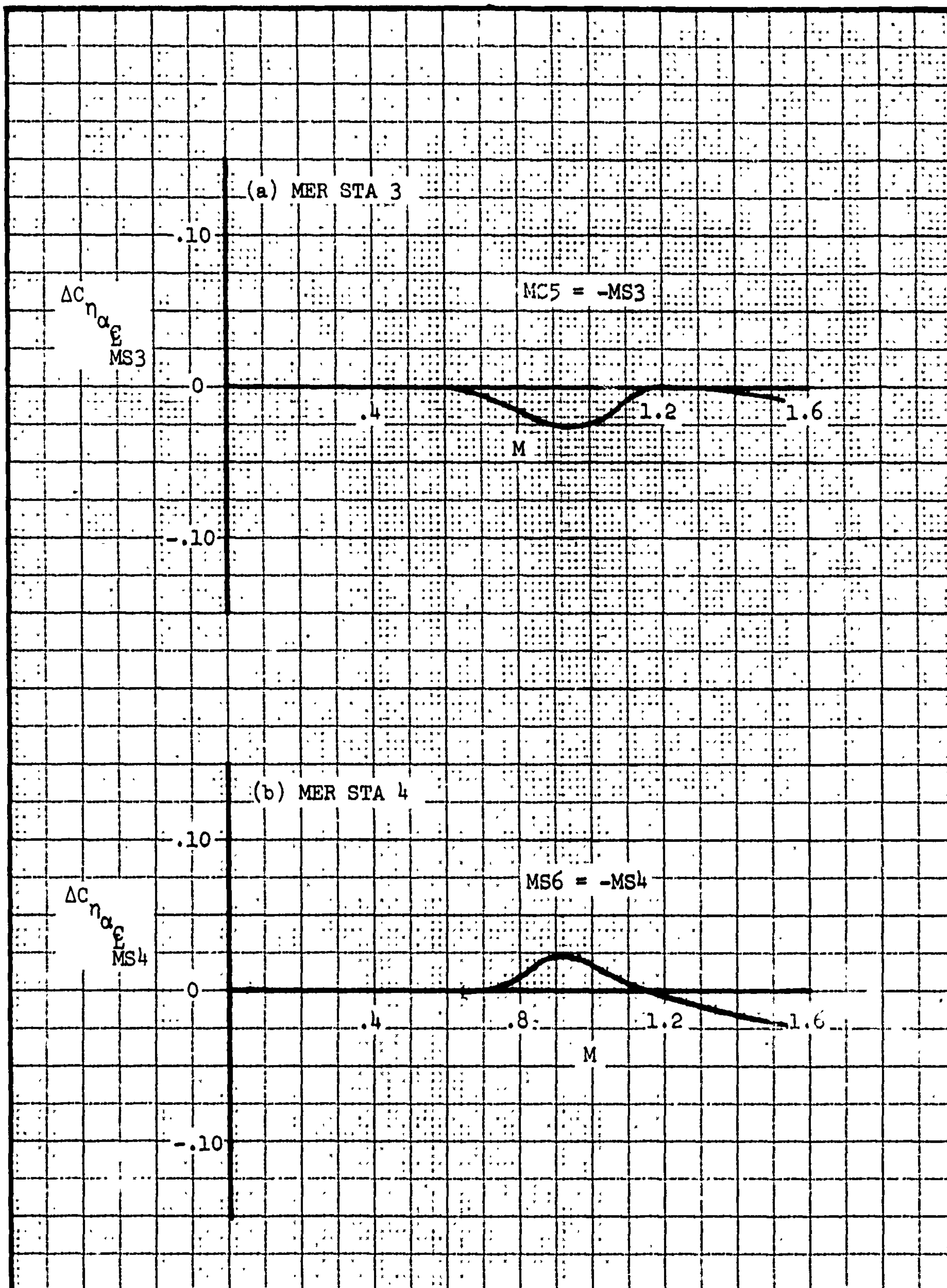



Figure 442. Yawing Moment Slope - Mach Number Correction for Stores Mounted on Fuselage Centerline, MER Stations 3-6

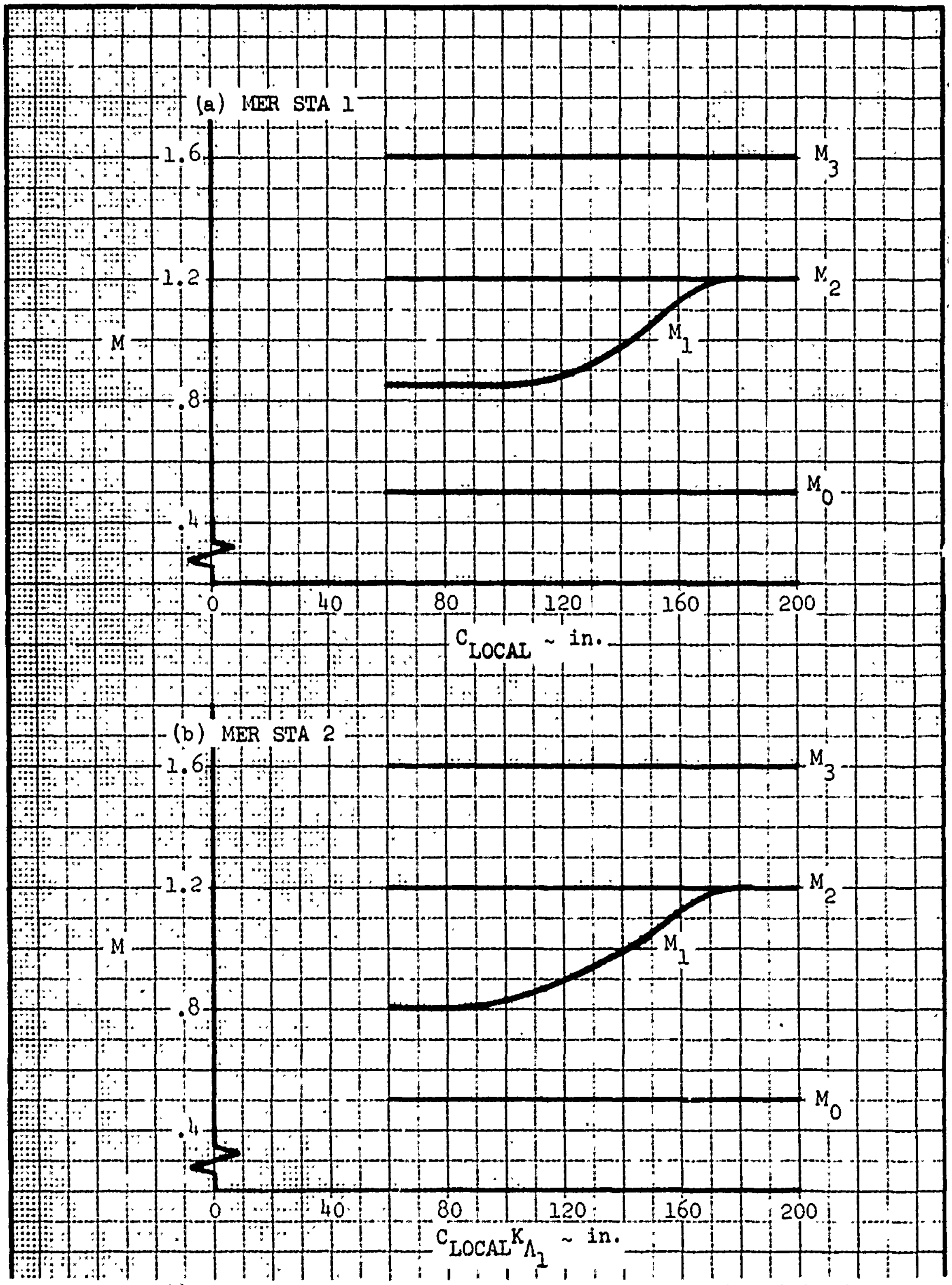



Figure 443. Yawing Moment Slope - Mach Number Break Points for MER Stations 1 and 2

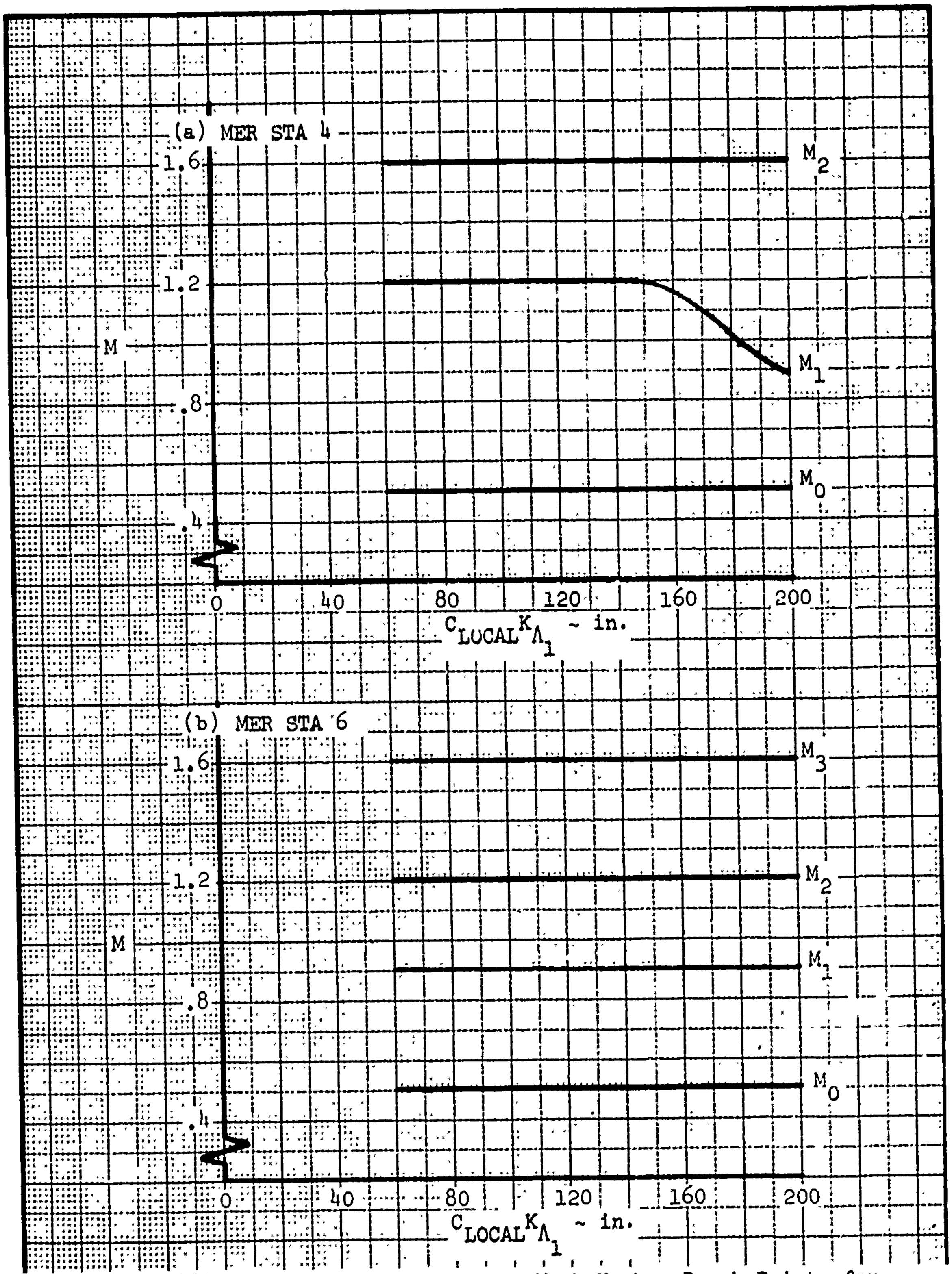



Figure 444. Yawing Moment Slope - Mach Number Break Points for MER Stations 4 and 6

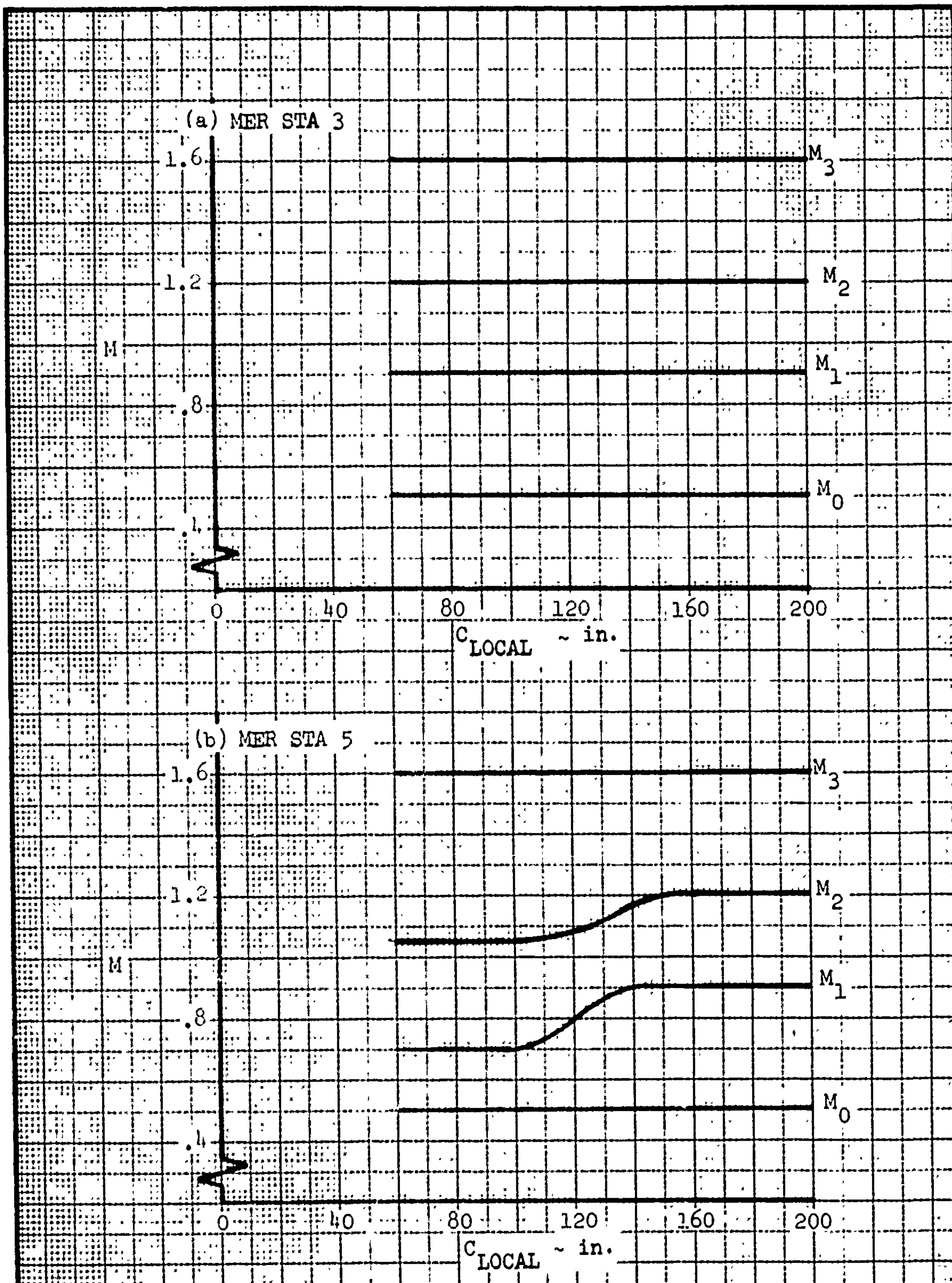



Figure 445. Yawing Moment Slope - Mach Number Break Points for MER Stations 3 and 5

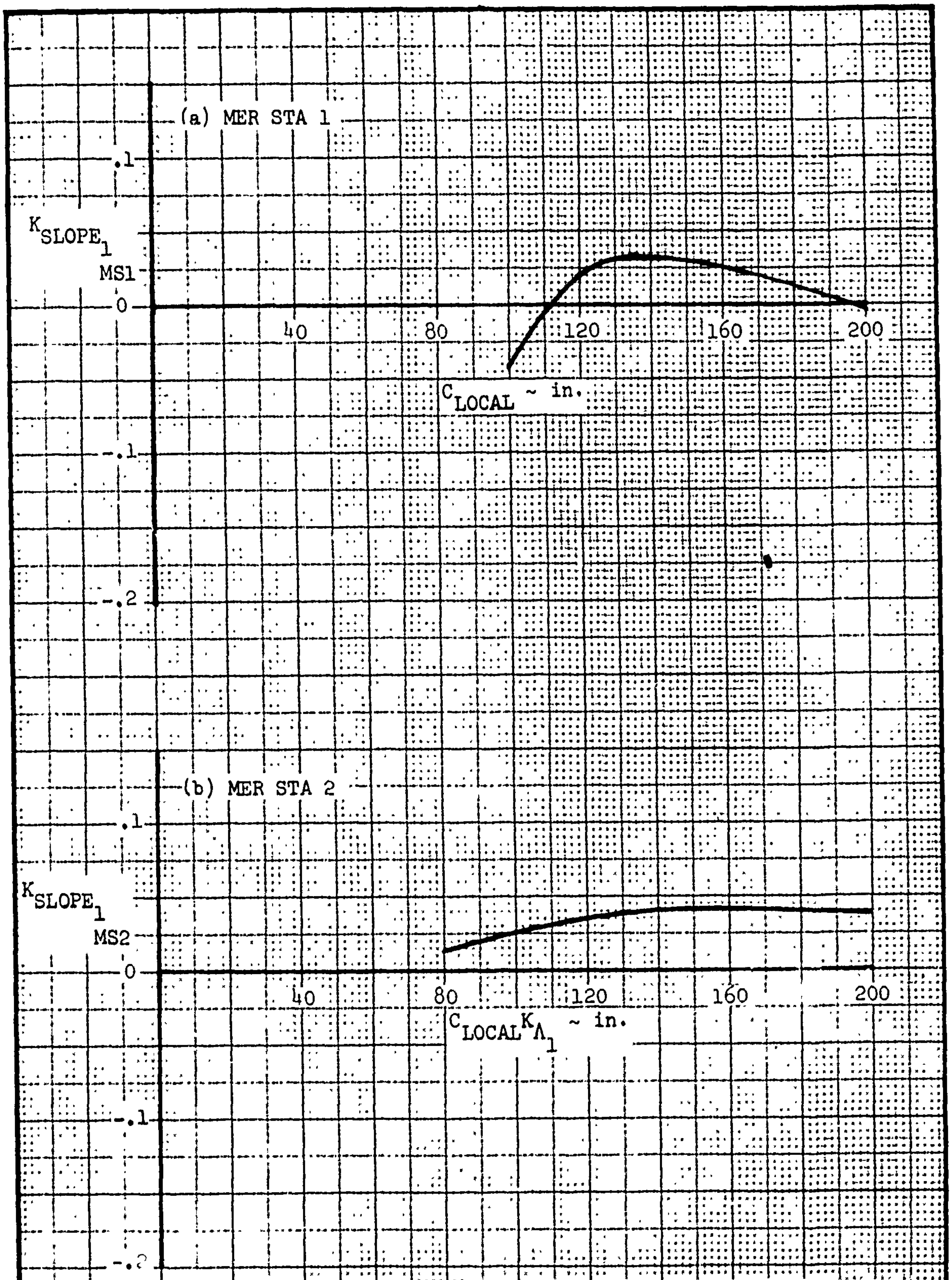



Figure 446. Yawing Moment Slope - $K_{SLOPE_1}$ for MER Stations 1 and 2

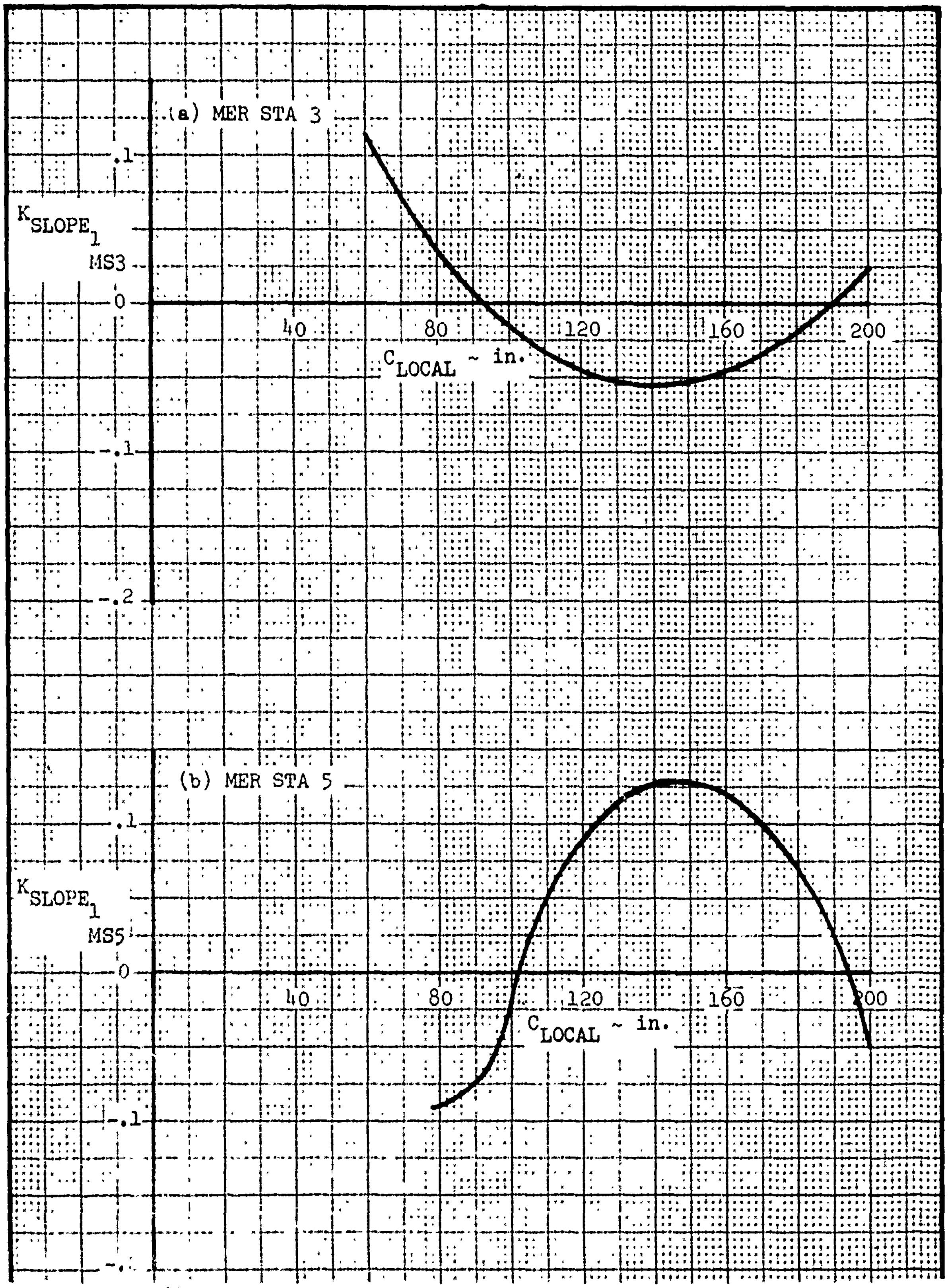



Figure 447. Yawing Moment Slope - $K_{SLOPE_1}$ for MER Stations 3 and 5

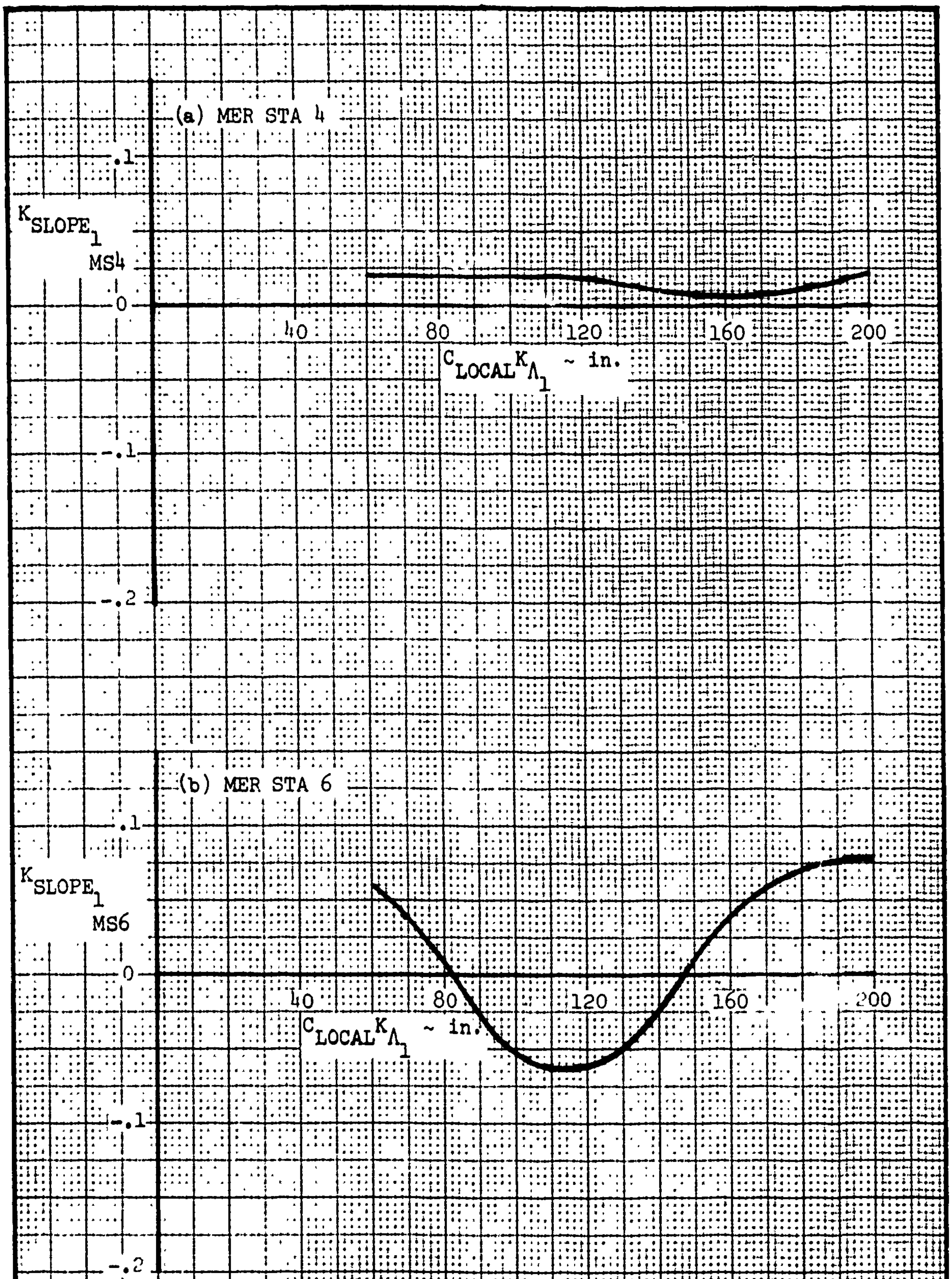



Figure 448. Yawing Moment Slope - $K_{SLOPE_1}$ for MER Stations 4 and 6

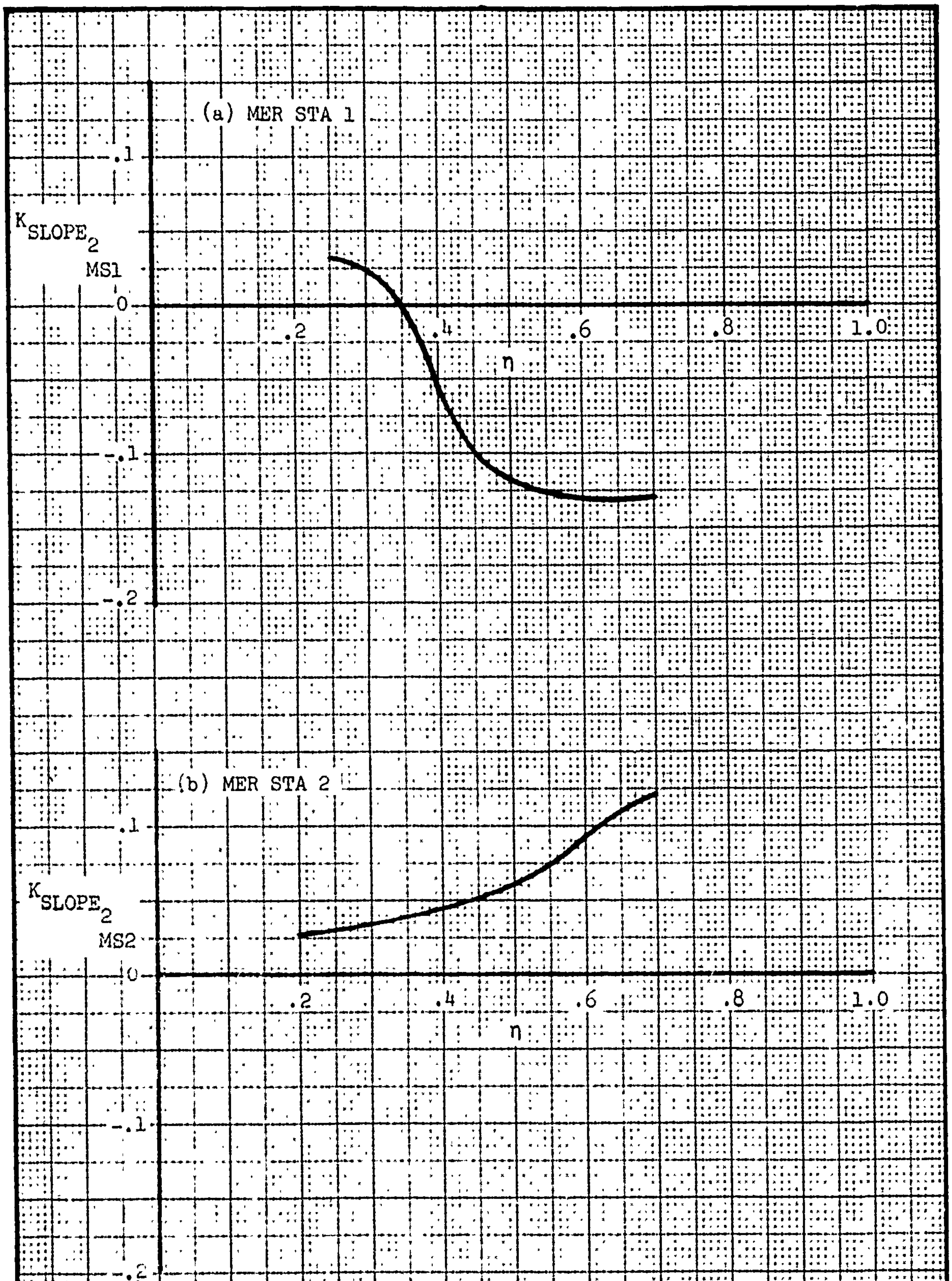



Figure 449. Yawing Moment Slope - $K_{SLOPE_2}$ for MER Stations 1 and 2

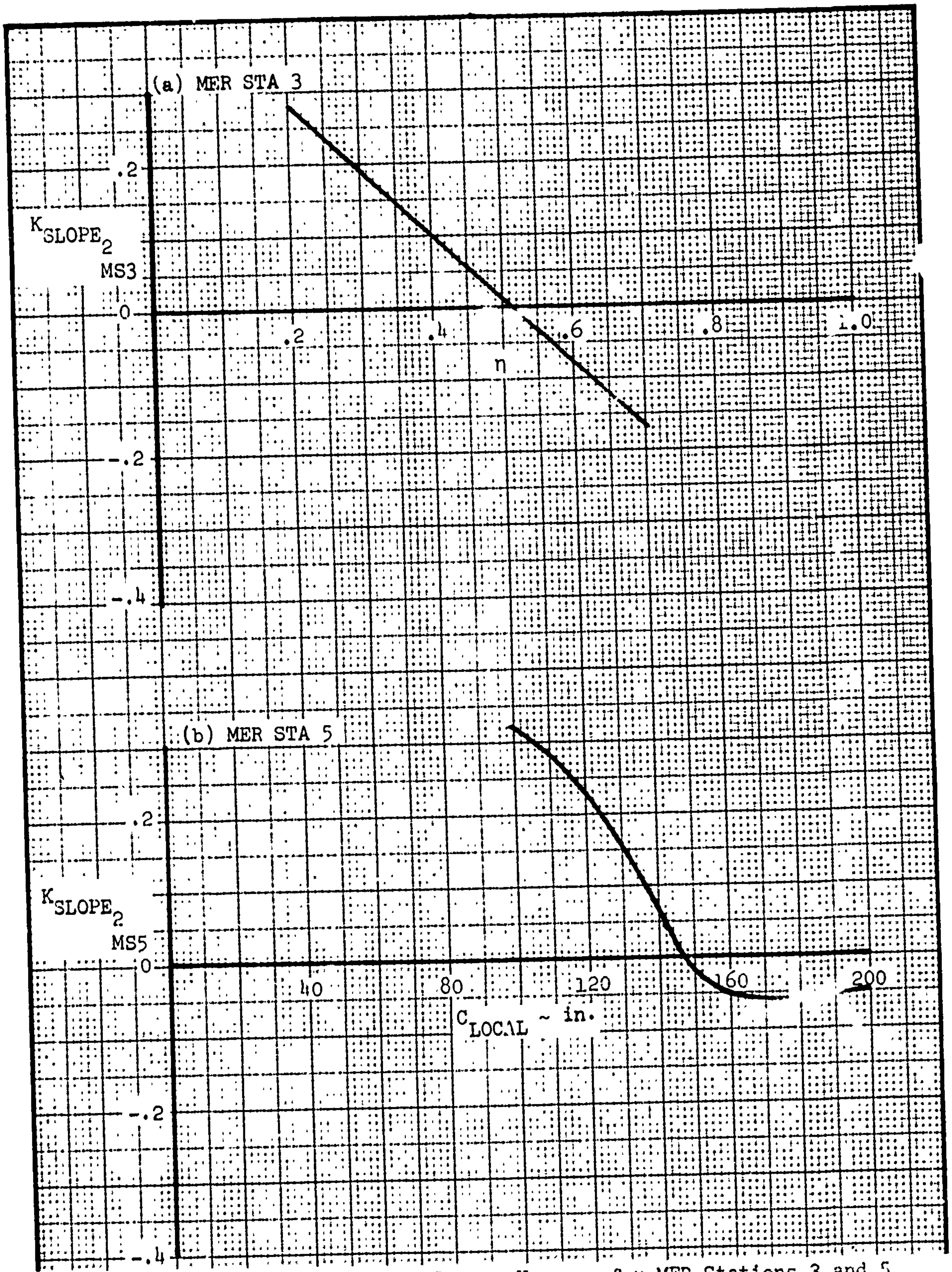



Figure 450. Yawing Moment Slope - $K_{SLOPE_2}$ for MER Stations 3 and 5

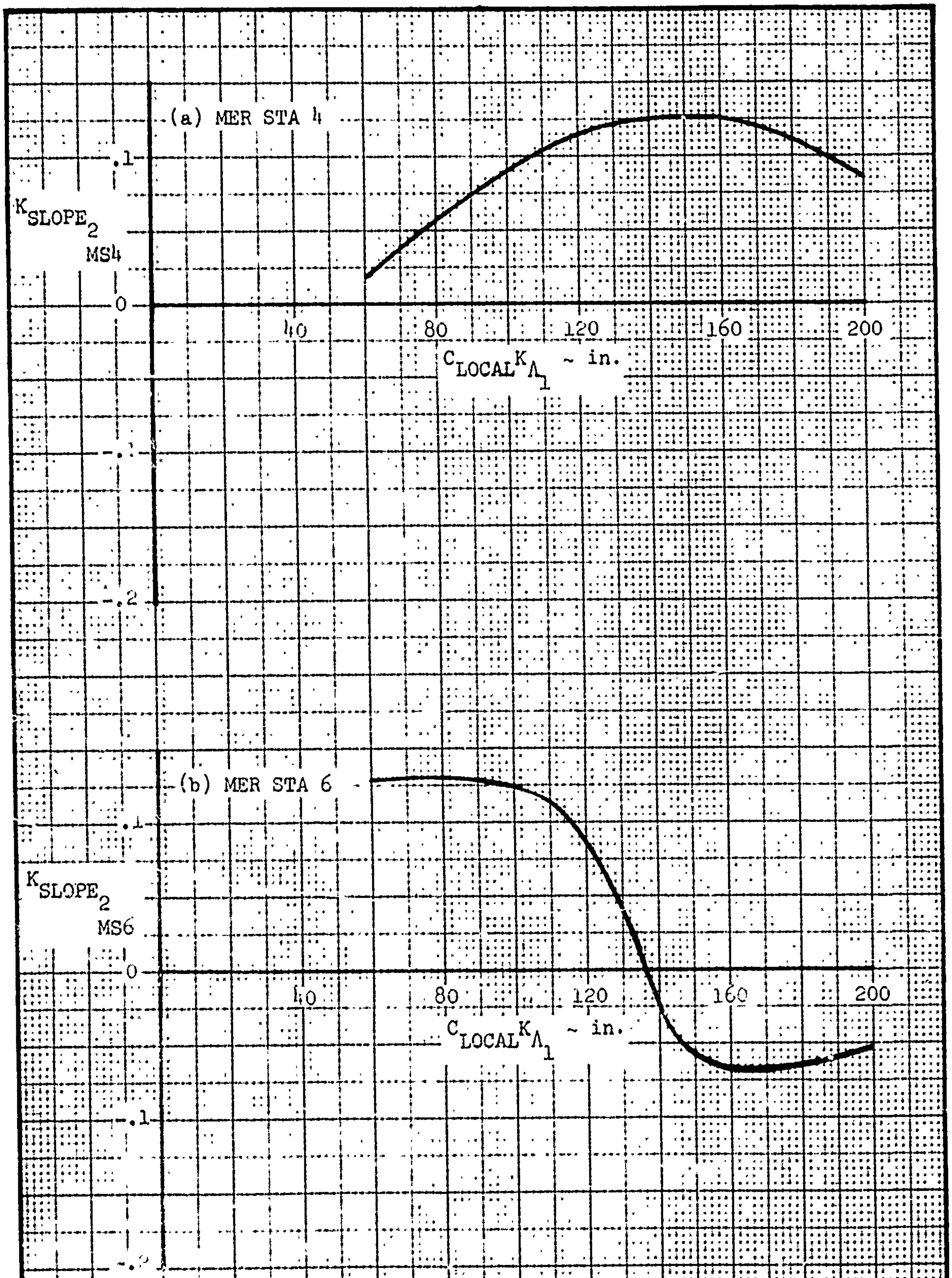



Figure 451. Yawing Moment Slope - $K_{SLOPE_2}$ for MER Stations 4 and 6

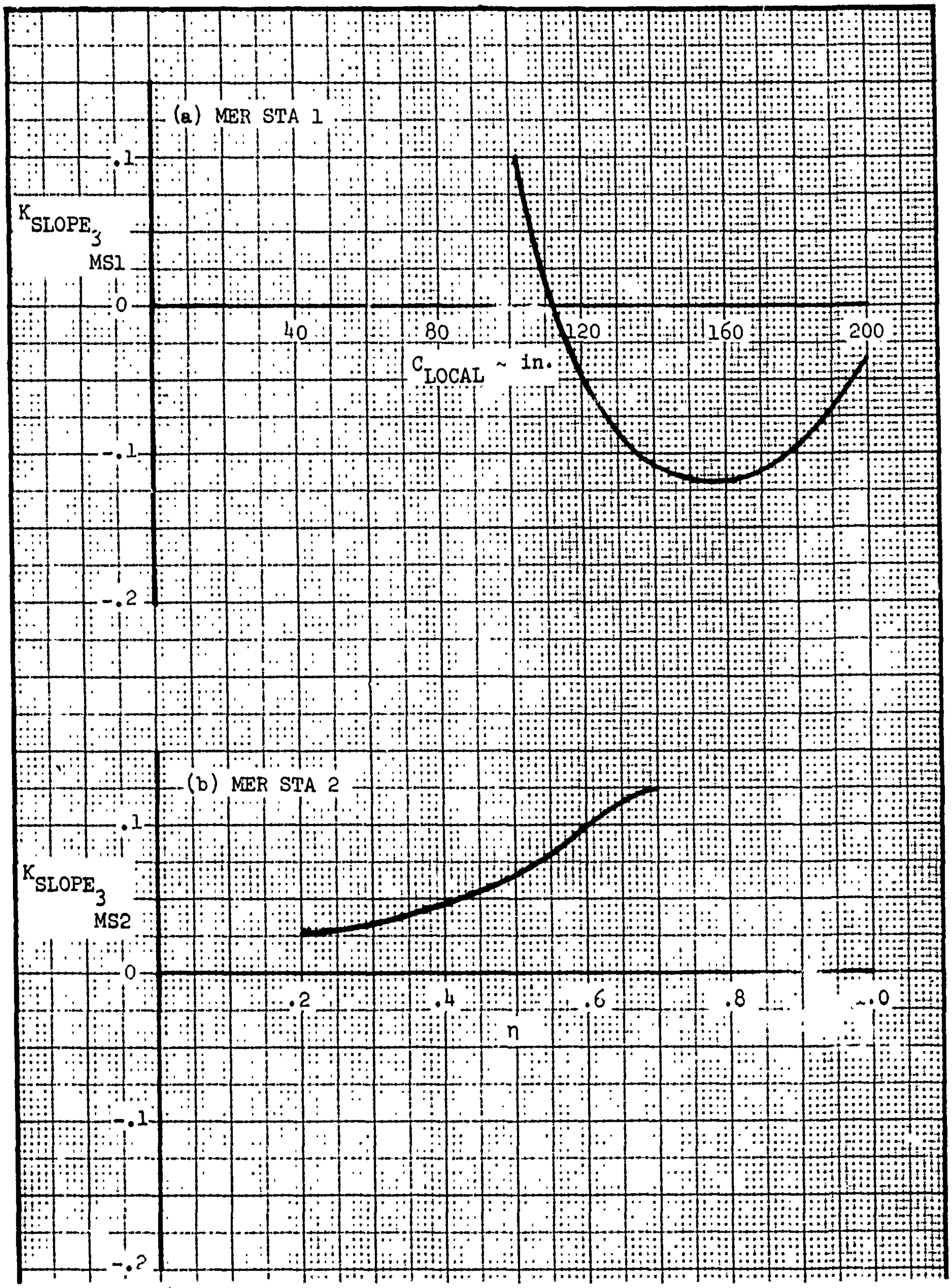



Figure 452. Yawing Moment Slope - $K_{SLOPE_3}$ for MER Stations 1 and 2

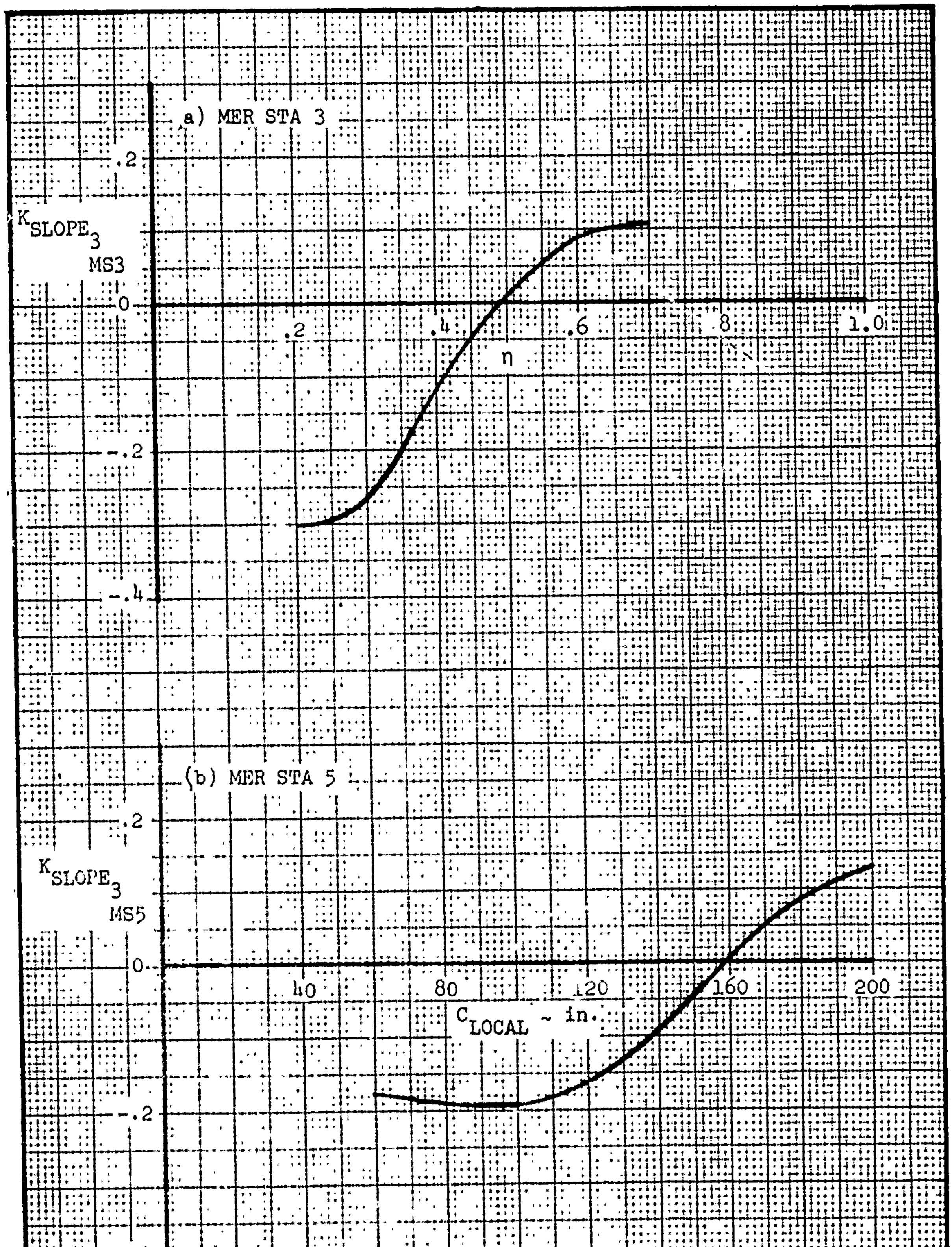



Figure 453. Yawing Moment Slope - $K_{SLOPE_3}$ for MER Stations 3 and 5

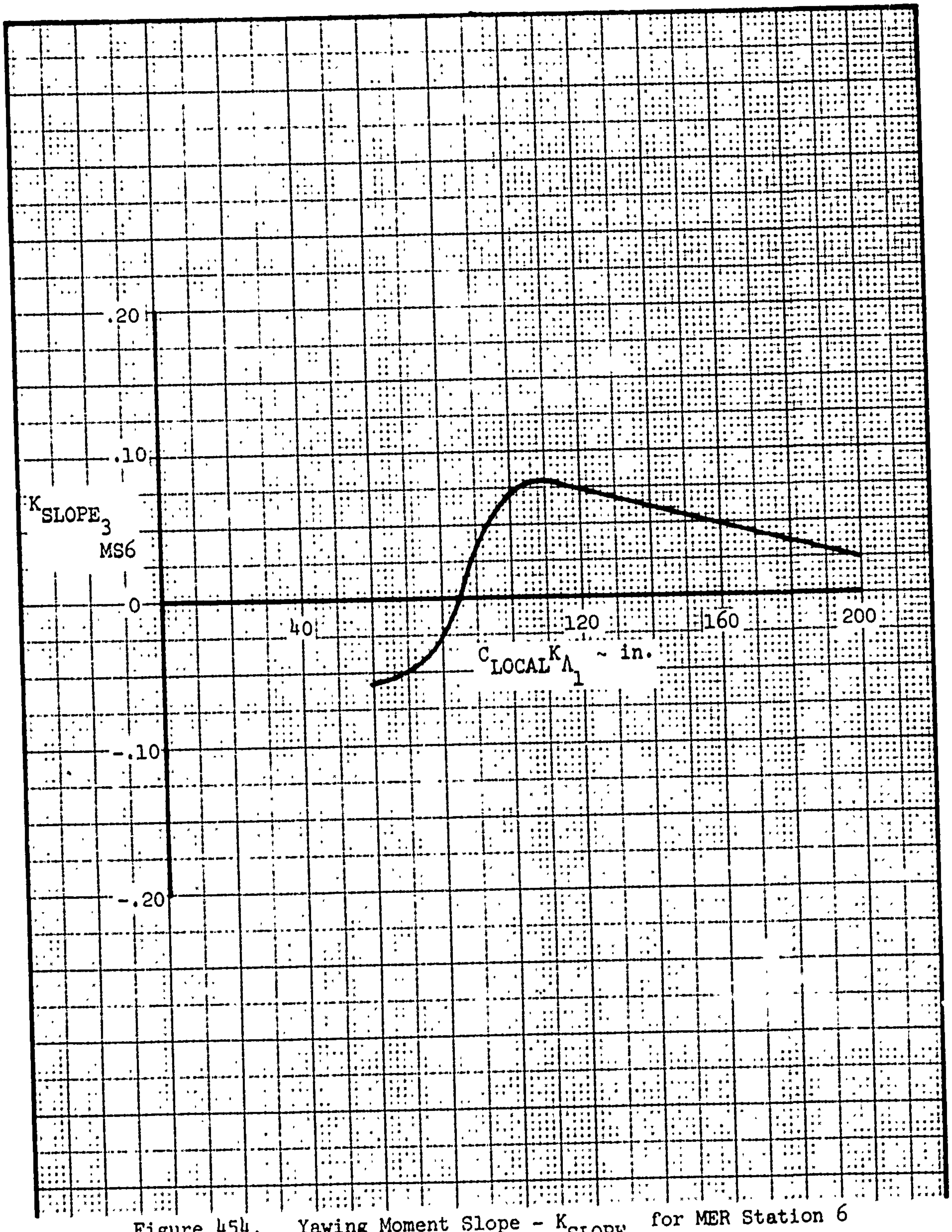



Figure 454. Yawing Moment Slope - $K_{SLOPE_3}$ for MER Station 6

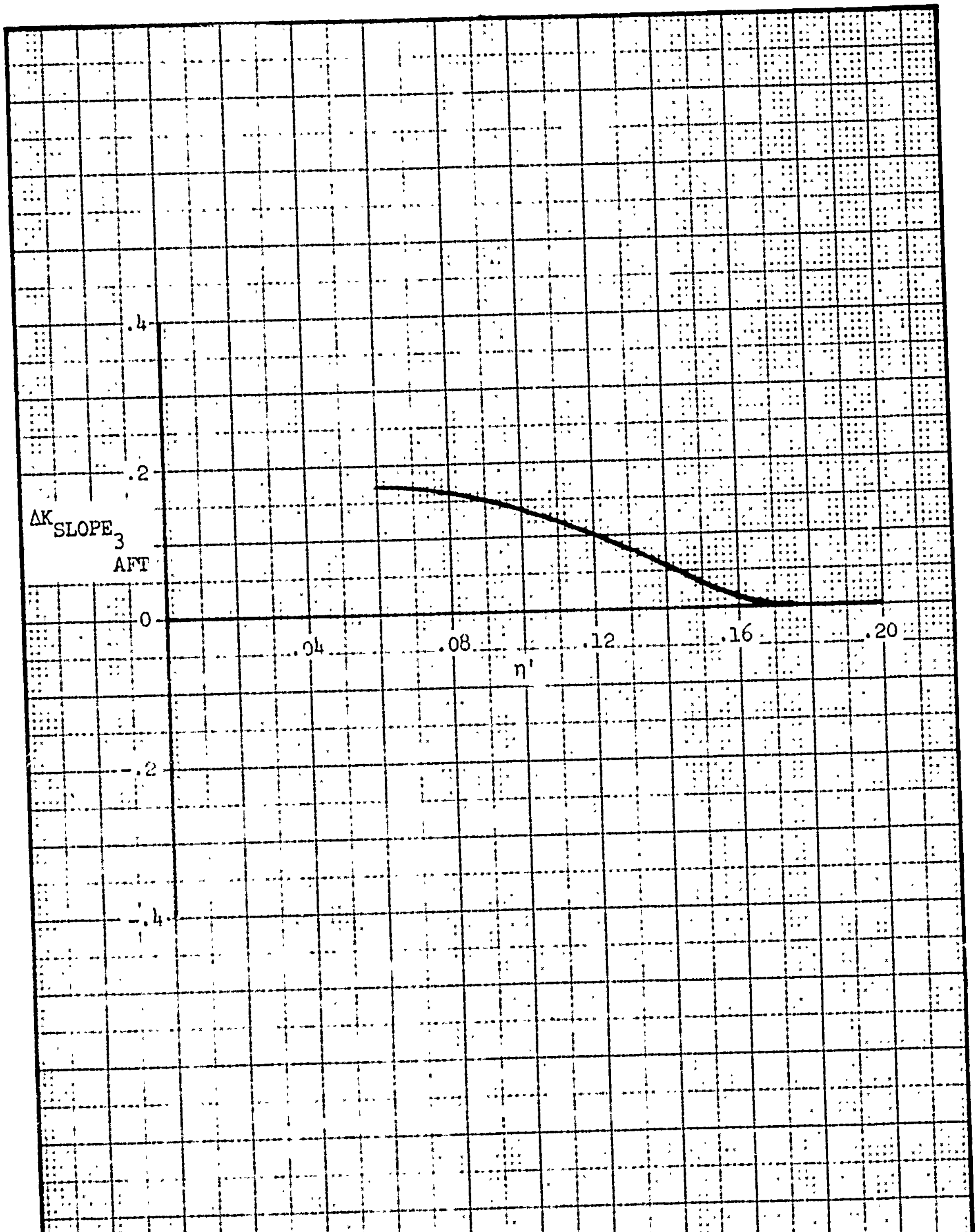



Figure 455. Yawing Moment Slope - Fuselage Interference Correction at Mach Break 3 for the Aft Cluster

### 4.2.1.3 Intercept Prediction

The value of captive store yawing moment at $\alpha$=0 for a store installed on a MER at M=0.5 is defined by the following relationships.

FUSELAGE CENTERLINE-MOUNTED STORES

MER Stations 1 and 2 (MS1,2):

$$\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\ PRED\\ MS1,2}} = 0 \quad \text{By symmetry}$$

MER Stations 3, 4, 5 and 6 (MS3-6):

$$\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\ PRED\\ MS3-6}} = S_{REF}\ \ell_{REF}\ C_{n_{\substack{\alpha=0\\ \mathrm{C_L}\\ MS3-6}}} = f(d)$$

where:

$C_{n_{\substack{\alpha=0\\ \mathrm{C_L}}}}$ - Fuselage centerline captive store yawing moment coefficient at $\alpha$=0 and M=0.5.

MER STA 3 - Figure 456

MER STA 4 - Figure 456

MER STA 5 - Figure 456

MER STA 6 - Figure 456

Note separate curves for finned and unfinned stores.

$S_{REF}$ - Store reference area, $\frac{\pi d^2}{4}$, ft $^2$.

$\ell_{REF}$ - Store reference length, d, ft.

WING-MOUNTED STORES

MER Stations 1, 3, 5 (MS1,3,5):

$$\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\ PRED\\ MS1,3,5}} = \left(C_{n_{\substack{\alpha=0\\ \mathrm{C_L}\\ MS1,3,5}}} + \Delta C_{n_{\substack{\alpha=0\\ MS1,3,5}}}\right) K_{SCALE_{YM}}$$

where:

$C_{n_{\alpha=0}}$ ℄ - Defined under FUSELAGE CENTERLINE-MOUNTED STORES. Note $C_{n_{\alpha=0}}$ ℄ MS1 $=0$ by symmetry.

$\Delta C_{n_{\alpha=0}}$ - Incremental yawing moment intercept correction for wing mounted stores presented as a function of $C_{LOCAL}$.

MER STA 1 - Figure 457

MER STA 3 - Figure 458

MER STA 5 - Figure 458

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

MER Stations 2, 4, 6 (MS2,4,6):

$$\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\ PRED\\ MS2,4,6}} = \left(C_{n_{\alpha=0}\,℄\,MS2,4,6} + \Delta C_{n_{\alpha=0}\,MS2,4,6}\right) K_{SCALE_{YM}} K_{\Lambda_1}$$

where:

$C_{n_{\alpha=0}}$ ℄ - Defined under FUSELAGE CENTERLINE-MOUNTED STORES. Note $C_{n_{\alpha=0}}$ ℄ MS2 $= 0$, by symmetry.

$\Delta C_{n_{\alpha=0}}$ - Incremental yawing moment intercept correction for wing mounted stores presented as a function of $C_{LOCAL} K_{\Lambda_1}$.

MER STA 2 - Figure 457

MER STA 4 - Figure 459

MER STA 6 - Figure 459

$K_{\Lambda_1}$ - Aircraft wing sweep correction factor based on the sweep angle of the quarter-chord, $\frac{\sin\ \Lambda}{\sin\ 45^\circ}$.

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

Example:

Compute the yawing moment at $\alpha$=0 for an M117 store on MER STA 6 carried on the A-7 center pylon at M=0.5.

Required for Computation:

$$C_{LOCAL} = 127.6 \text{ in.}$$

$$K_{\Lambda_1} = \frac{\sin 35^\circ}{\sin 45^\circ} = .811$$

$$d = 16.13 \text{ in.}$$

$$C_{n_{\alpha=0}\,_{C_L\,MS6}} = .18$$ - Figure 456

$$K_{SCALE_{YM}} = 1.92 \text{ ft.}^3$$ - Subsection 4.2.1.1

$$\Delta C_{n_{\alpha=0}\,_{MS6}} = .48$$ - Figure 459

$$\left(\frac{YM}{q}\right)_{\alpha=0\,_{PRED\,MS6}} = \left(.18+.48\right)(1.92)(.811) = 1.03 \text{ ft}^3$$

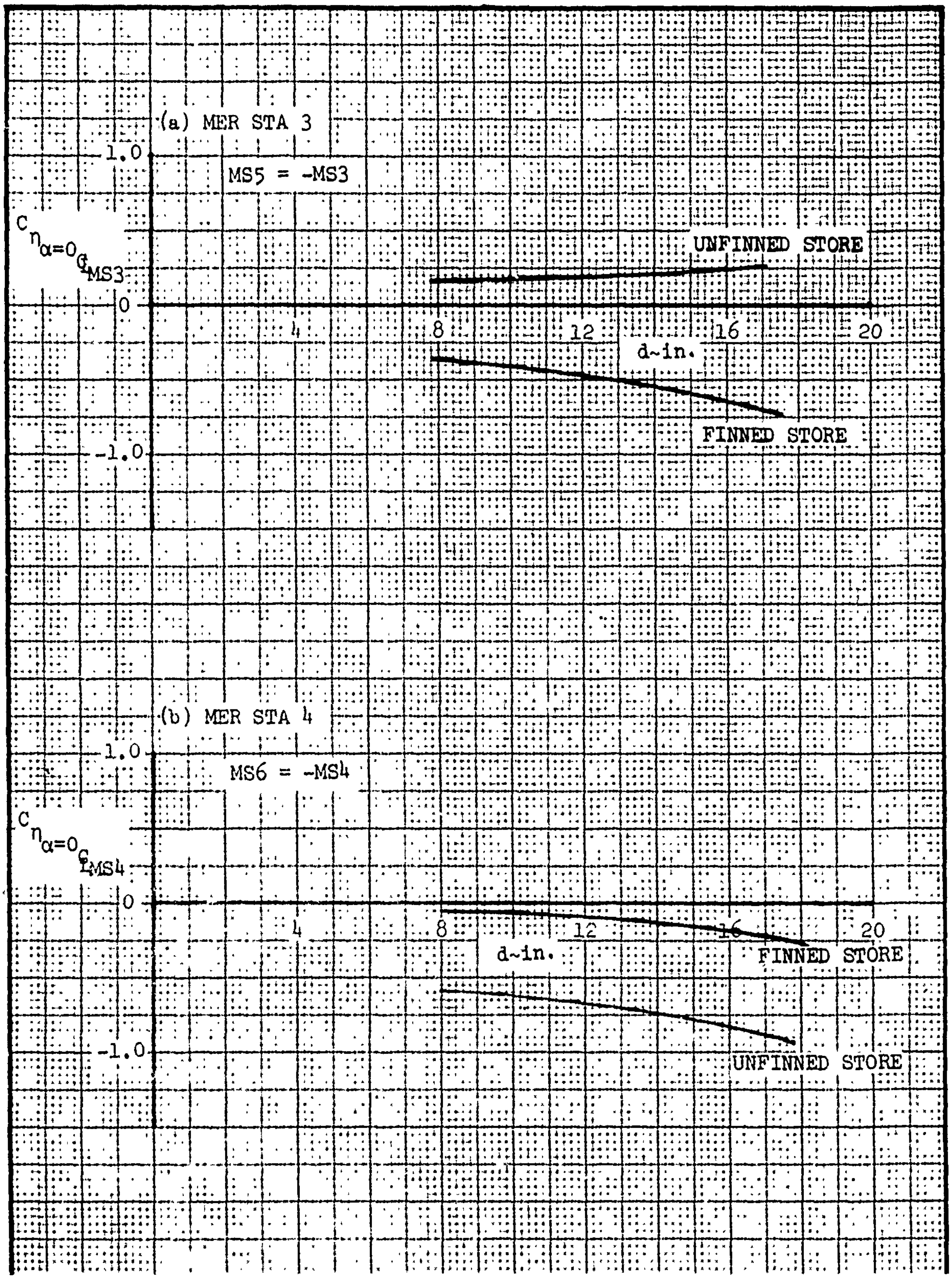



Figure 4?6. Yawing Moment Intercept - Stores Mounted on Fuselage Centerline, MER Stations 3-6

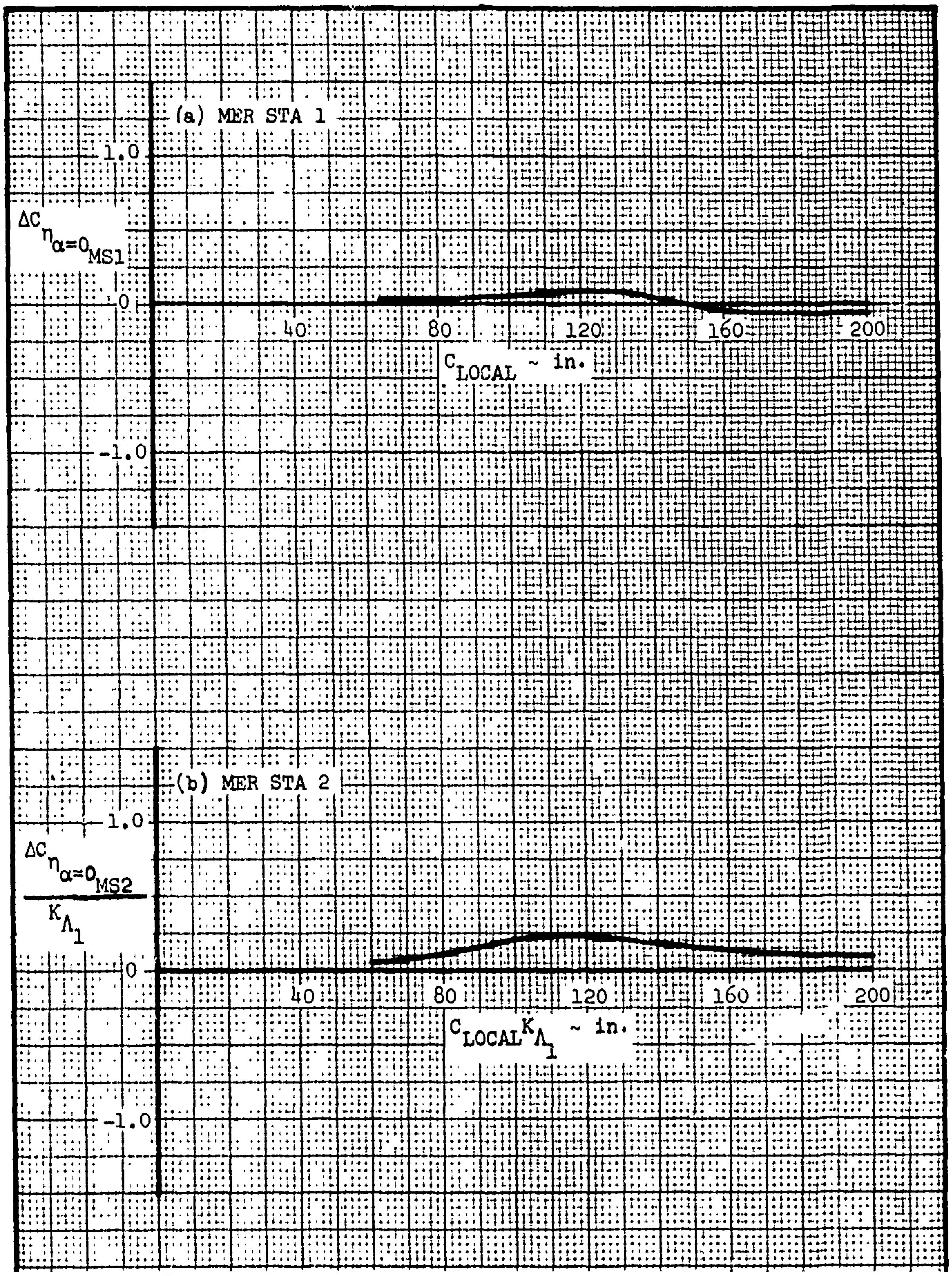



Figure 457. Yawing Moment Intercept - Incremental Coefficient for Wing-Mounted Stores, MER Stations 1 and 2

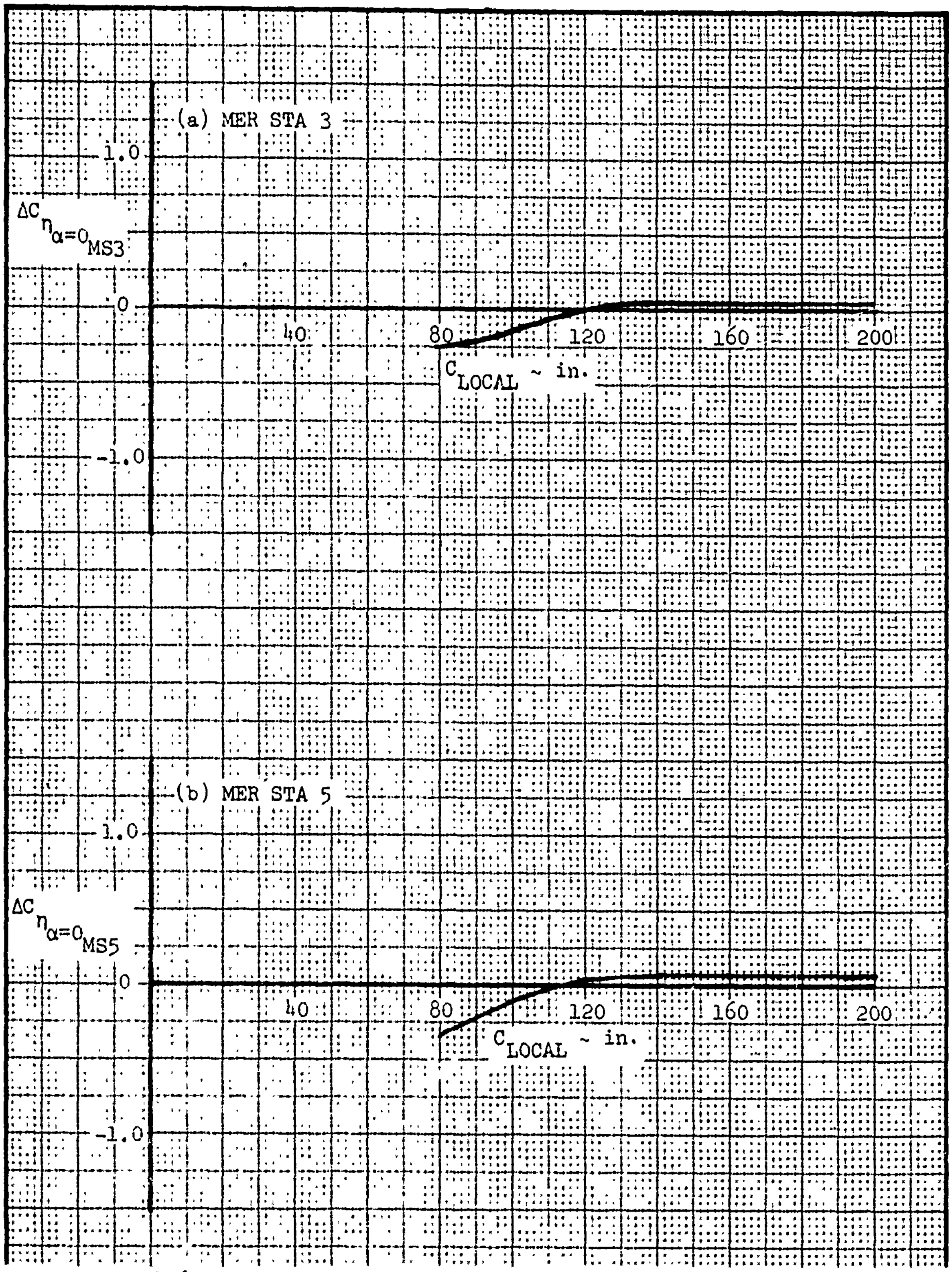



Figure 458. Yawing Moment Intercept - Incremental Coefficient for Wing-Mounted Stores, MER Stations 3 and 5

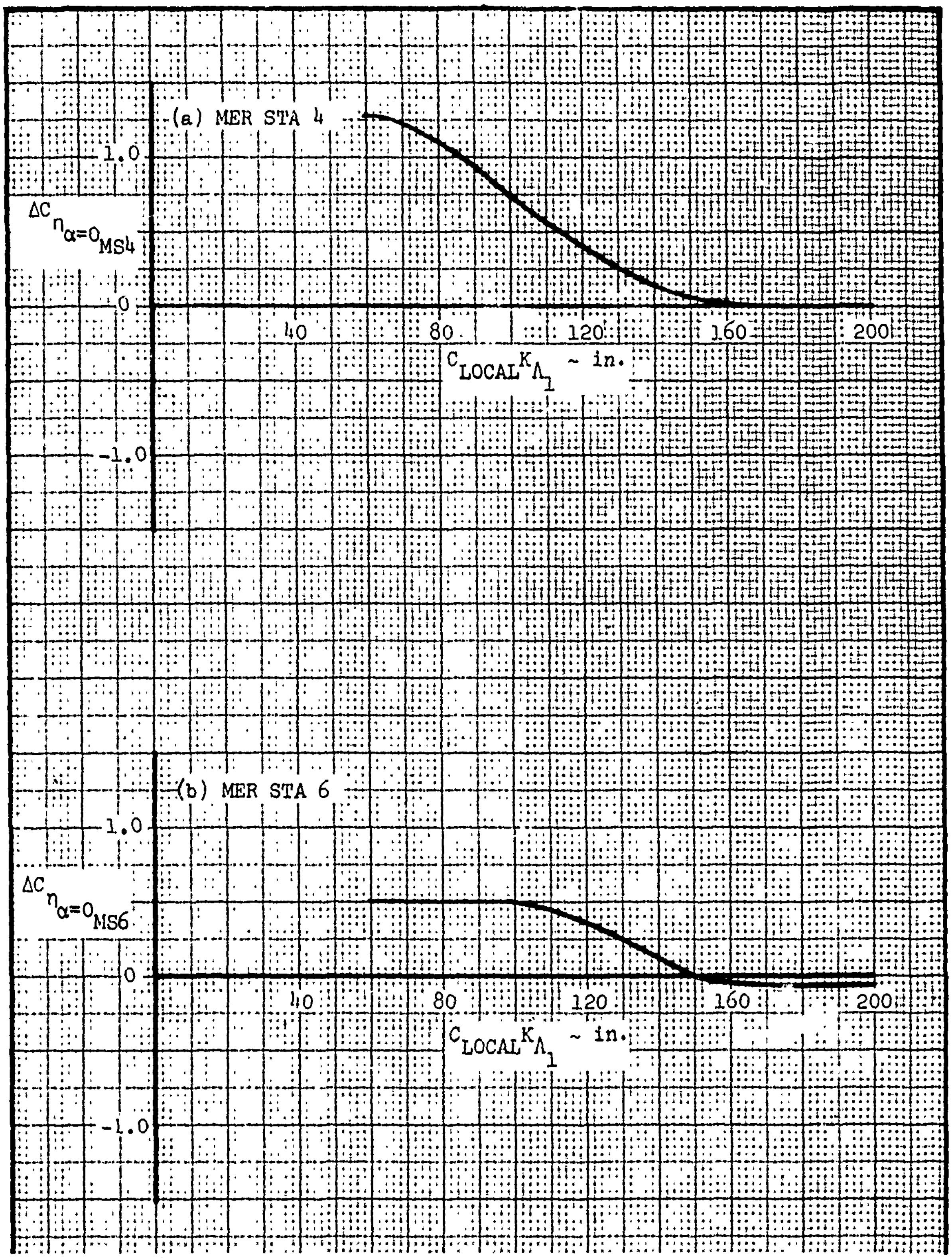



Figure 459. Yawing Moment Intercept - Incremental Coefficient for Wing-Mounted Stores, MER Stations 4 and 6

4.2.1.4 Intercept Mach Number Correction

To compute the value of captive store yawing moment at $\alpha=0$ between M=0.5 and M=1.6, use the following expression.

$$\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\M=x}} = \left(\frac{YM}{q}\right)_{\substack{\alpha=0\\PRED}} + \Delta\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\M=x}}$$

where:

$\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\PRED}}$ - Predicted yawing moment intercept at M=0.5, Subsection 4.2.1.3, $ft^3$

$\Delta\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\M=x}}$ - Increment in yawing moment intercept at M=x, $ft^3$

FUSELAGE CENTERLINE MOUNTED STORES

MER Stations 1 and 2 (MS1, 2):

$$\Delta\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\M=x\\MS1,2}} = 0, \text{ by symmetry}$$

MER Stations 3, 4, 5 and 6 (MS3-6):

$$\Delta\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\M=x\\MS3-6}} = K_{SCALE_{YM}} \Delta C_{n_{\substack{\alpha=0\\ \mathcal{C}_L\\MS3-6}}} = f(M)$$

$\Delta C_{n_{\substack{\alpha=0\\ \mathcal{C}_L\\MS3-6}}}$ - Incremental yawing moment intercept coefficient as a function of Mach number.

MER STA 3 - Figure 460

MER STA 4 - Figure 460

MER STA 5 - Figure 460

MER STA 6 - Figure 460

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

## WING-MOUNTED STORES

The procedure for calculating the Mach number correction to yawing moment intercept for wing-mounted stores is essentially the same as the procedure for yawing moment slope in Subsection 4.2.1.2. The variation in Mach break points ($M_o$, $M_1$, $M_2$) is presented in Figures 461 through 463 as a function of $C_{LOCAL}$ and/or $K_{\Lambda_1}$. The slopes of $C_{n_{\alpha=0}}$ versus Mach number between break points for each MER station are presented in Figures 464 through 471. The expressions below define the calculation procedures for each MER Station over the applicable Mach range.

Break 1 ($M_1$): $M_o \leq x \leq M_1$

MER Stations 1, 3, 4, 5 and 6 (MS1,3-6):

$$\Delta\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\M=x\\MS1,3-6}} = \left[\left(x-M_o\right) K_{SLOPE_{1_{MS1,3-6}}}\right] K_{SCALE_{YM}}$$

where:

$K_{SLOPE_1}$ - The variation of $C_{n_{\alpha=0}}$ with Mach number between $M_o$ and $M_1$.

MER STA 1 - Figure 464

MER STA 3 - Figure 465

MER STA 4 - Figure 466

MER STA 5 - Figure 465

MER STA 6 - Figure 466

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

MER Station 2 (MS2):

$$\Delta\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\M=x\\MS2}} = \left[\left(x-M_o\right)\left(K_{SLOPE_{1_{MS2}}} + \Delta K_{SLOPE_{1_{MS2}}}\right)\right] K_{SCALE_{YM}}$$

where:

$K_{SLOPE_1}$ - The variation of $C_{n_{\alpha=0}}$ with Mach number between $M_o$ and $M_1$.

MER STA 2 - Figure 464

$\Delta K_{SLOPE_1}$ - Incremental slope due to fuselage interference.

MER STA 2 - Figure 467

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

Break 2 ($M_2$): $M_1 \leq x \leq M_2$

MER Station 1, 2, 3, 5 and 6 (MS1-3,5,6):

$$\Delta\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\M=x\\MS1-3,5,6}} = \left[\left(M_1-M_o\right)\left(K_{SLOPE_1}{}_{MS1-3,5,6} + \Delta K_{SLOPE_1}{}_{MS2}\right) + \left(x-M_1\right) K_{SLOPE_2}{}_{MS1-3,5,6}\right] K_{SCALE_{YM}}$$

where:

$K_{SLOPE_1}$ - Defined under Break 1.

$\Delta K_{SLOPE_1}$ - Defined under Break 1.

$K_{SLOPE_2}$ - The variation in $C_{n_{\alpha=0}}$ with Mach number between $M_1$ and $M_2$.

MER STA 1 - Figure 468

MER STA 2 - Figure 468

MER STA 3 - Figure 469

MER STA 5 - Figure 469

MER STA 6 - Figure 470

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

MER Station 4 (MS4):

$$\Delta\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\M=x\\MS4}} = \left[\left(M_1-M_o\right) K_{SLOPE_1}{}_{MS4} + \left(x-M_1\right)\left(K_{SLOPE_2}{}_{MS4} + \Delta K_{SLOPE_2}{}_{MS4}\right)\right] \cdot \left(K_{SCALE_{YM}}\right)$$

where:

$K_{SLOPE_1}$ - Defined under Break 1.

$K_{SLOPE_2}$ - The variation in $C_{n_{\alpha=0}}$ with Mach number between $M_1$ and $M_2$.

MER STA 4 - Figure 470

$\Delta K_{SLOPE_2}$ - Incremental slope due to pylon height.

MER STA 4 - Figure 471

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

A similar computational procedure is included in Subsection 4.2.1.2.

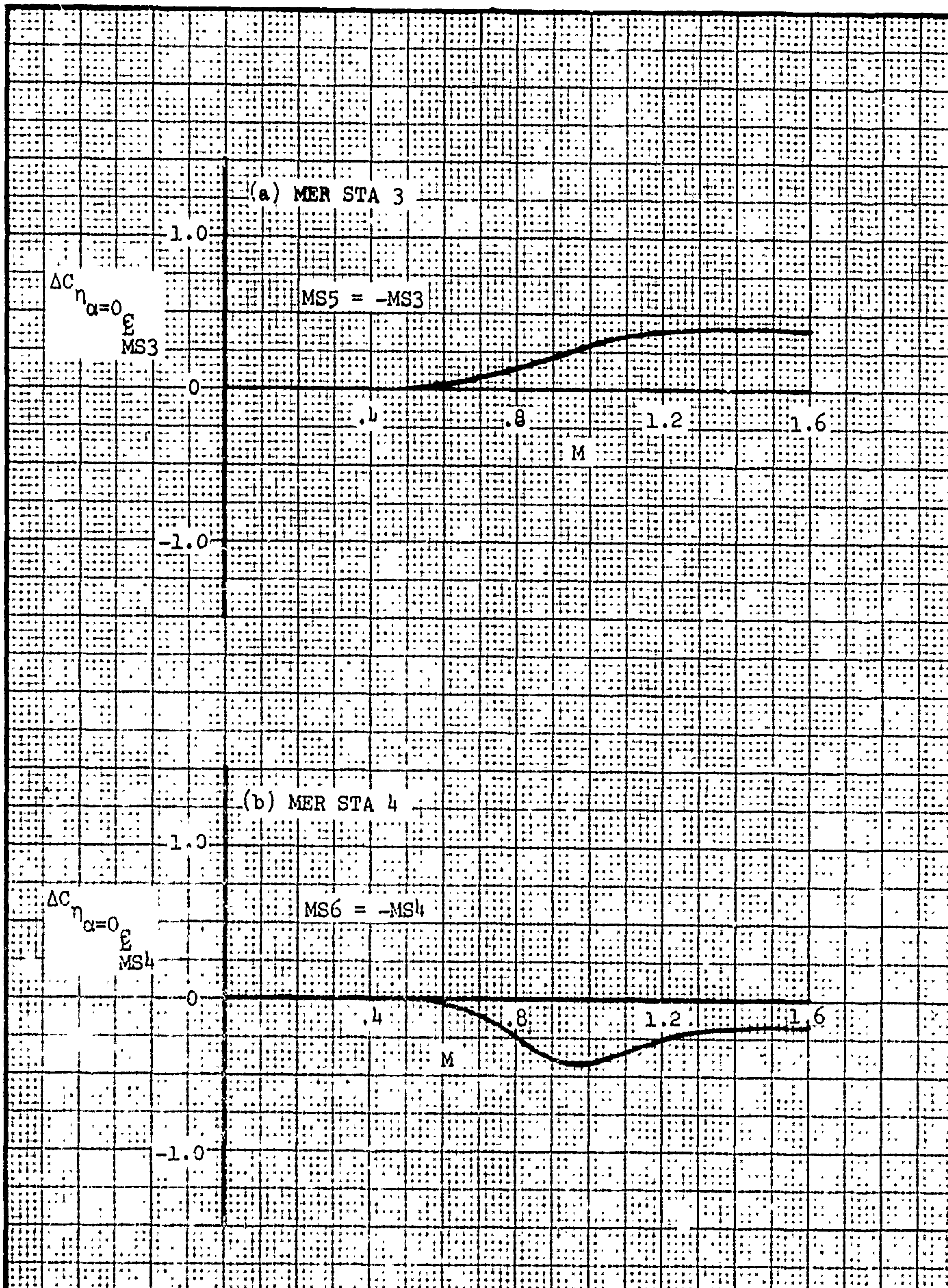



Figure 460. Yawing Moment Intercept - Mach Number Correction for Stores Mounted on Fuselage Centerline, MER Stations 3-6

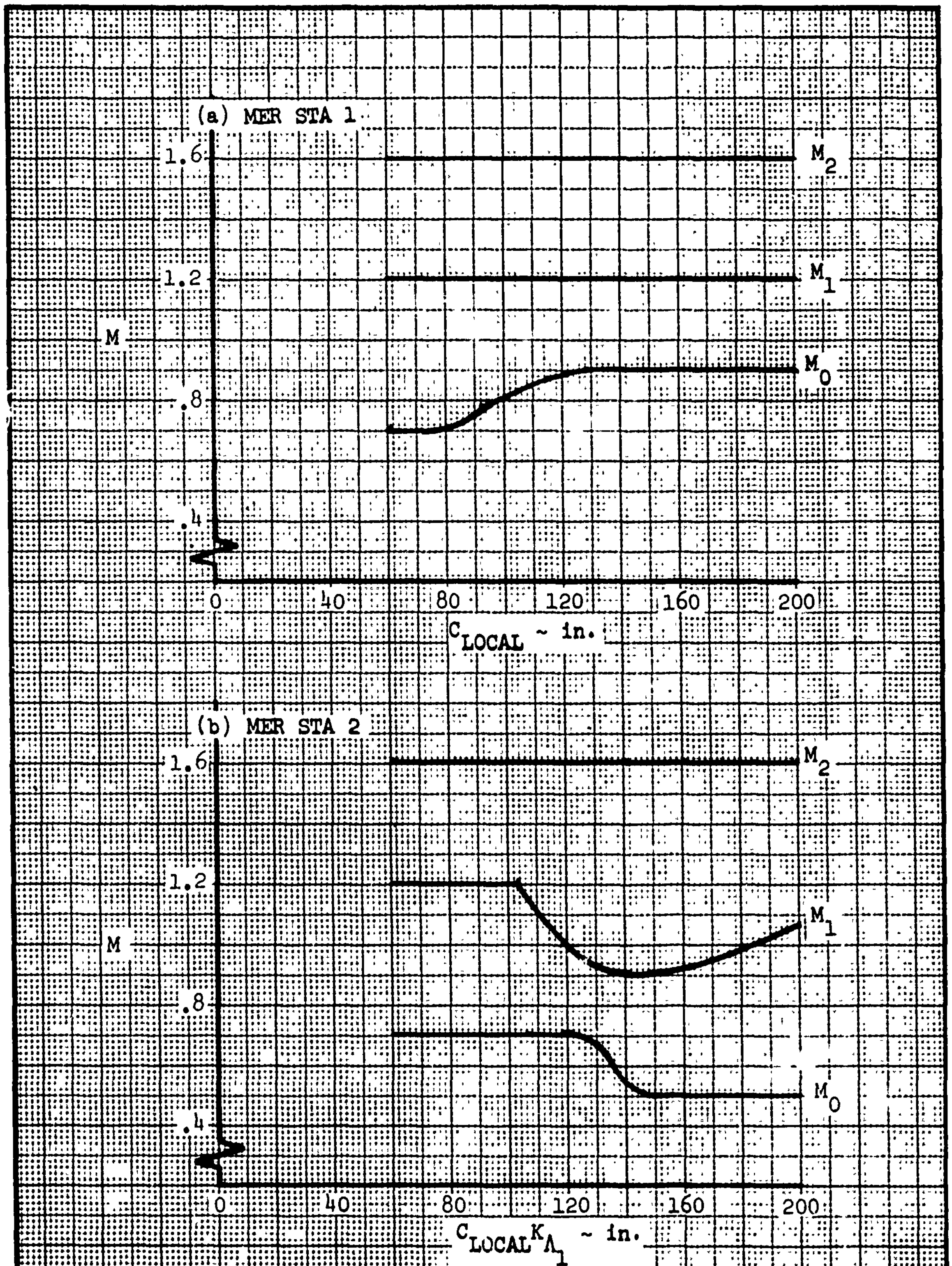



Figure 461. Yawing Moment Intercept - Mach Number Break Points for MER Stations 1 and 2

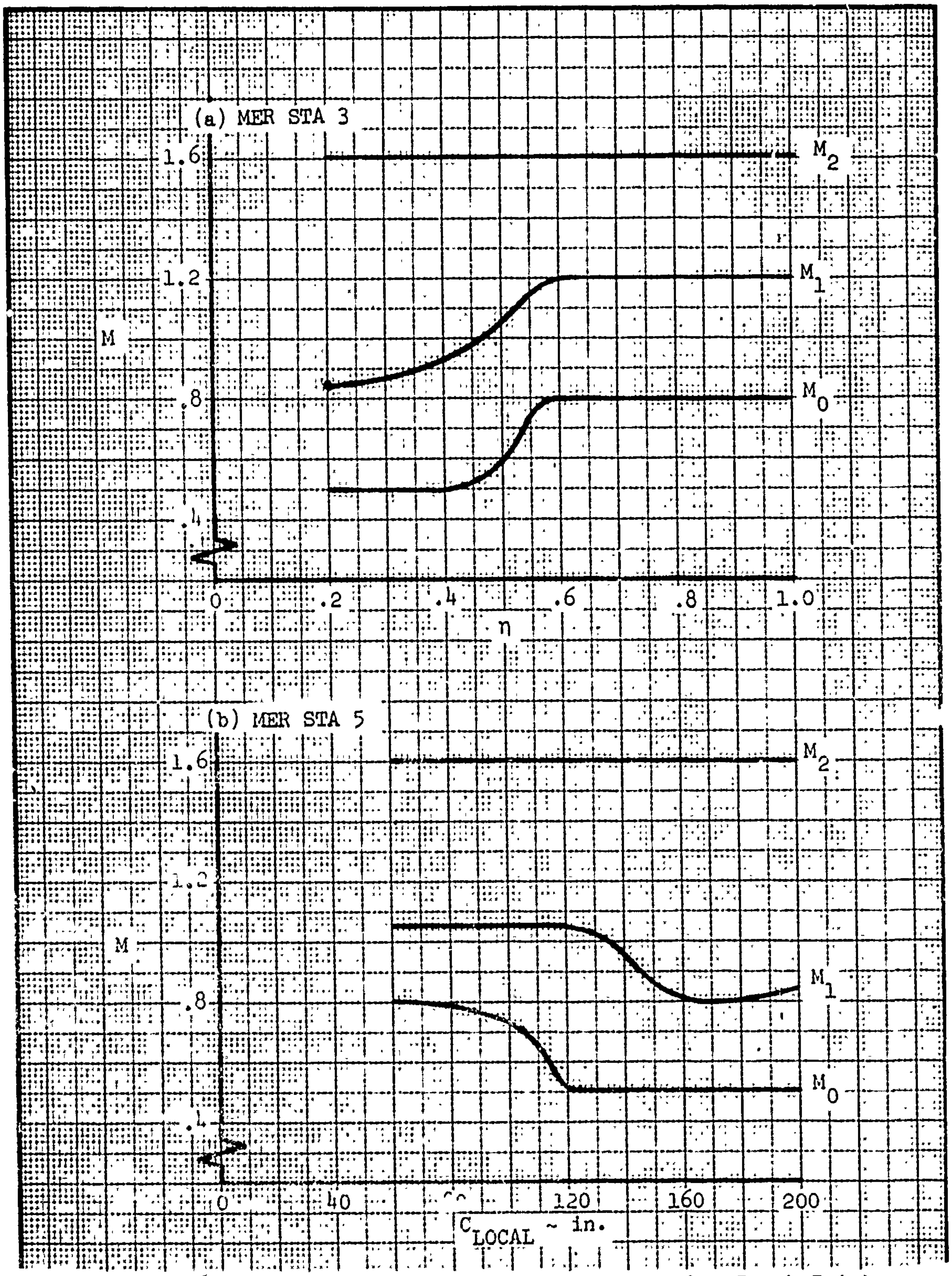



Figure 462. Yawing Moment Intercept - Mach Number Break Points for MER Stations 3 and 5

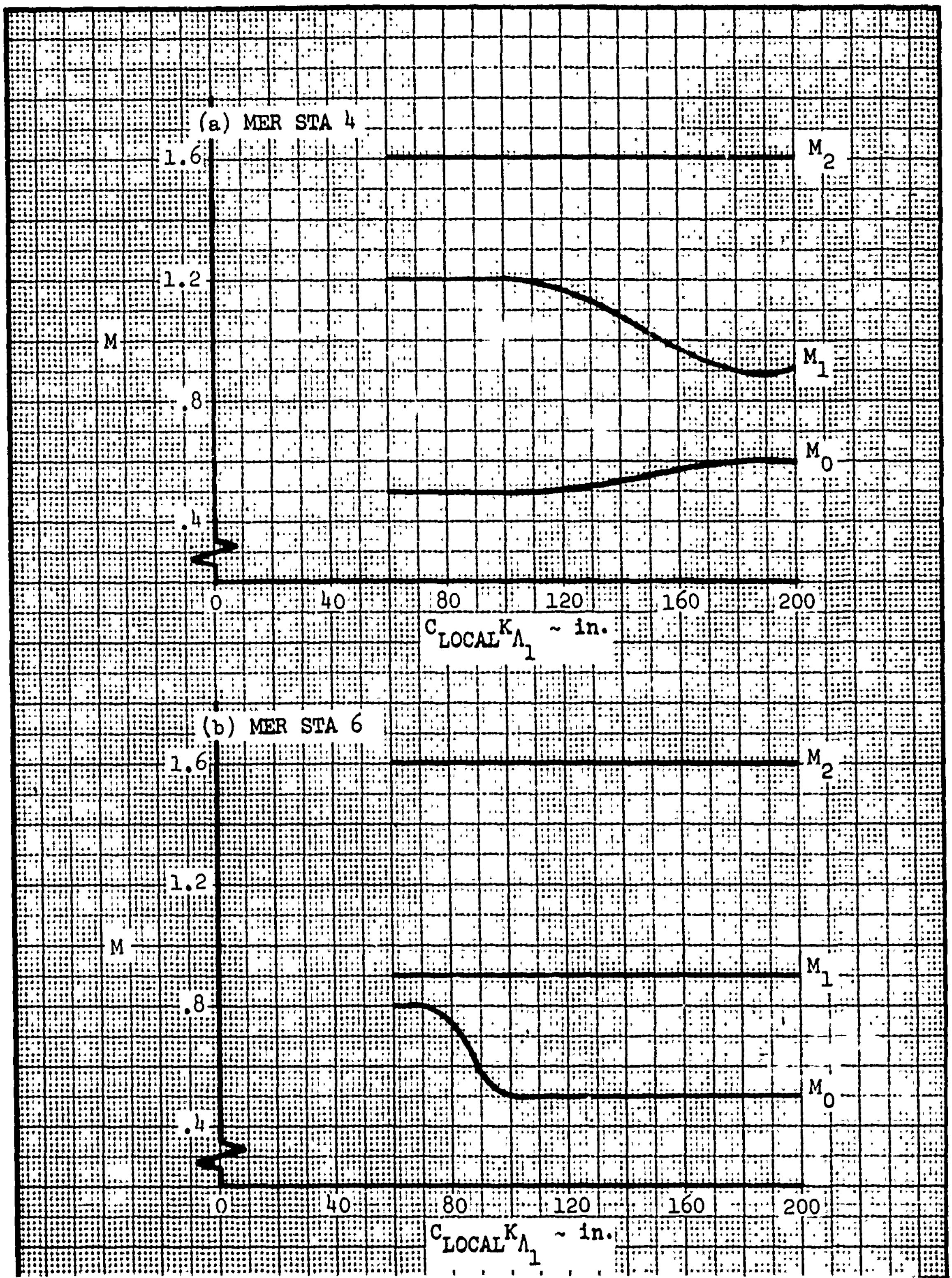



Figure 463. Yawing Moment Intercept - Mach Number Break Points for MER Stations 4 and 6

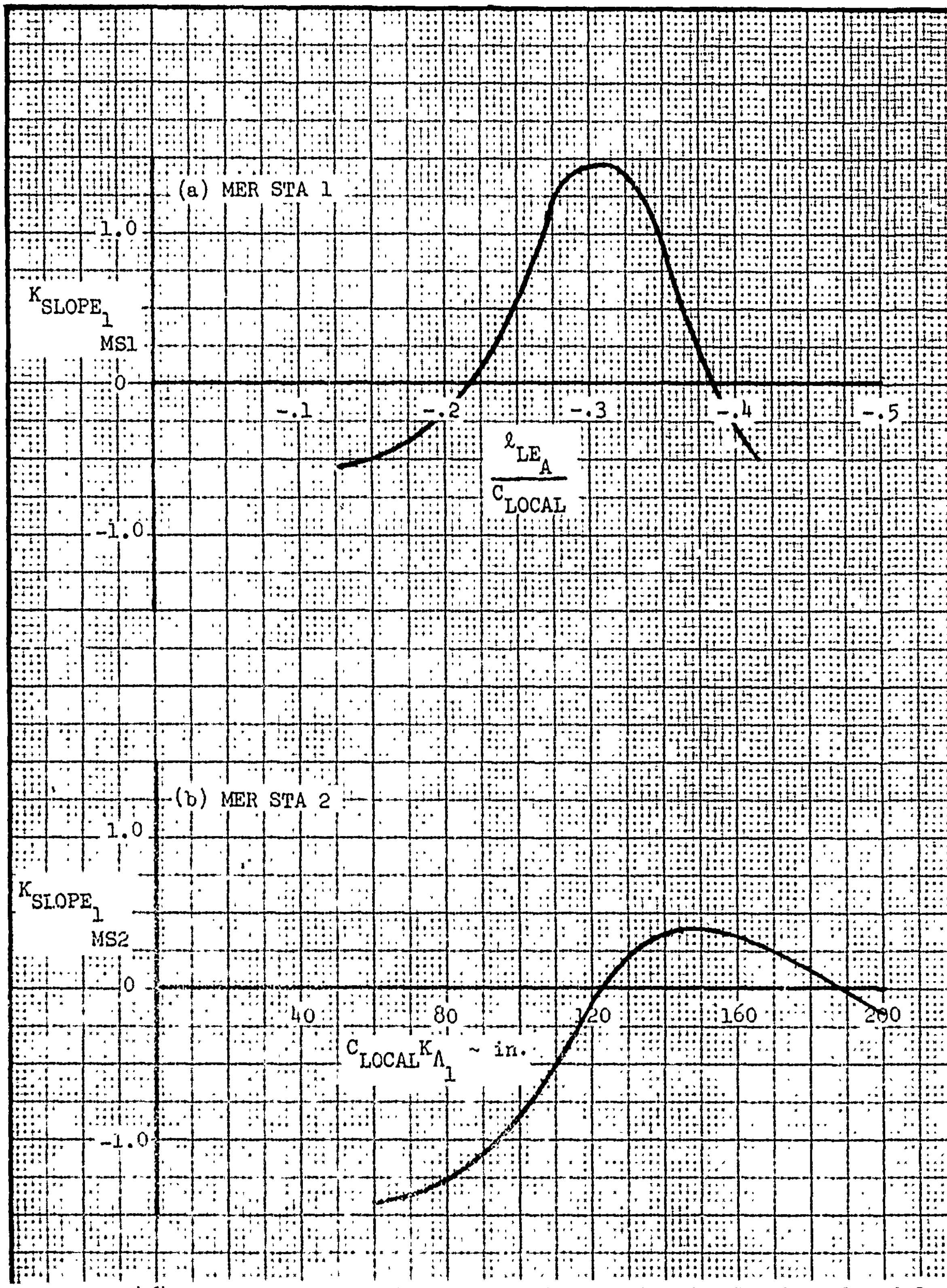



Figure 464. Yawing Moment Intercept - $K_{SLOPE_1}$ for MER Stations 1 and 2

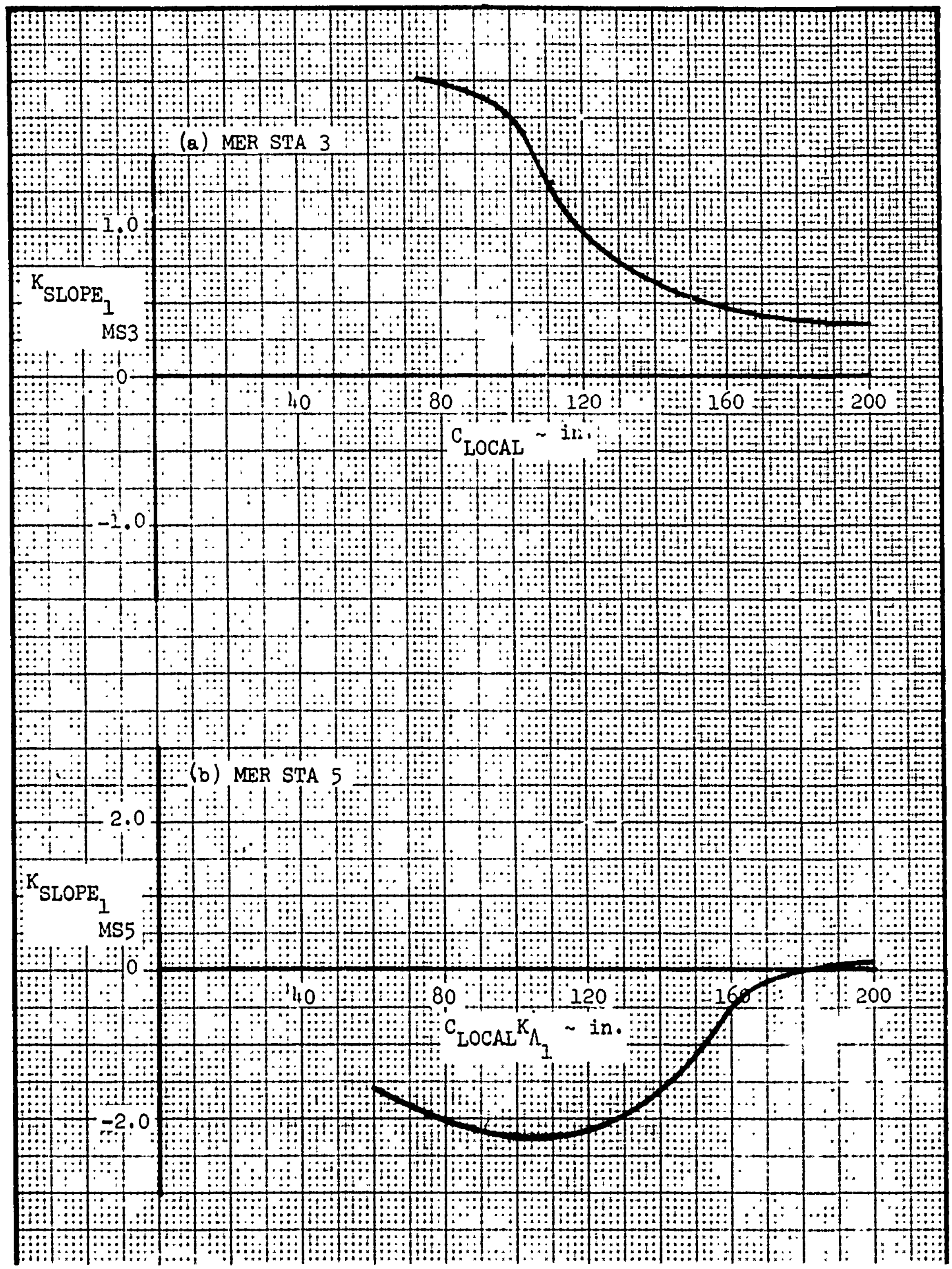



Figure 465. Yawing Moment Intercept - $K_{SLOPE_1}$ for MER Stations 3 and 5

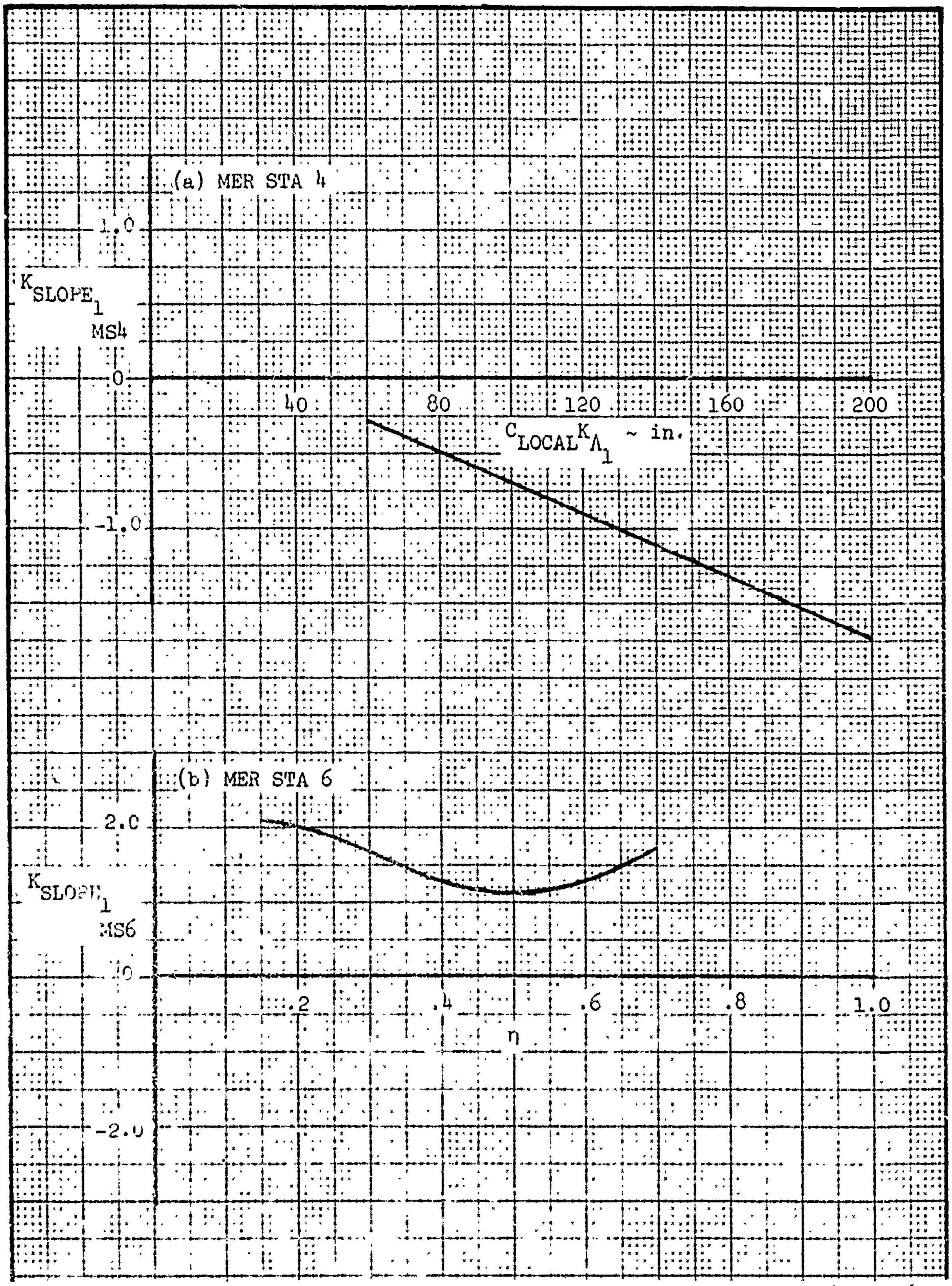



Figure [illegible]. Yawing Moment Intercept - $K_{SLOPE_1}$ for MER Stations 4 and 6

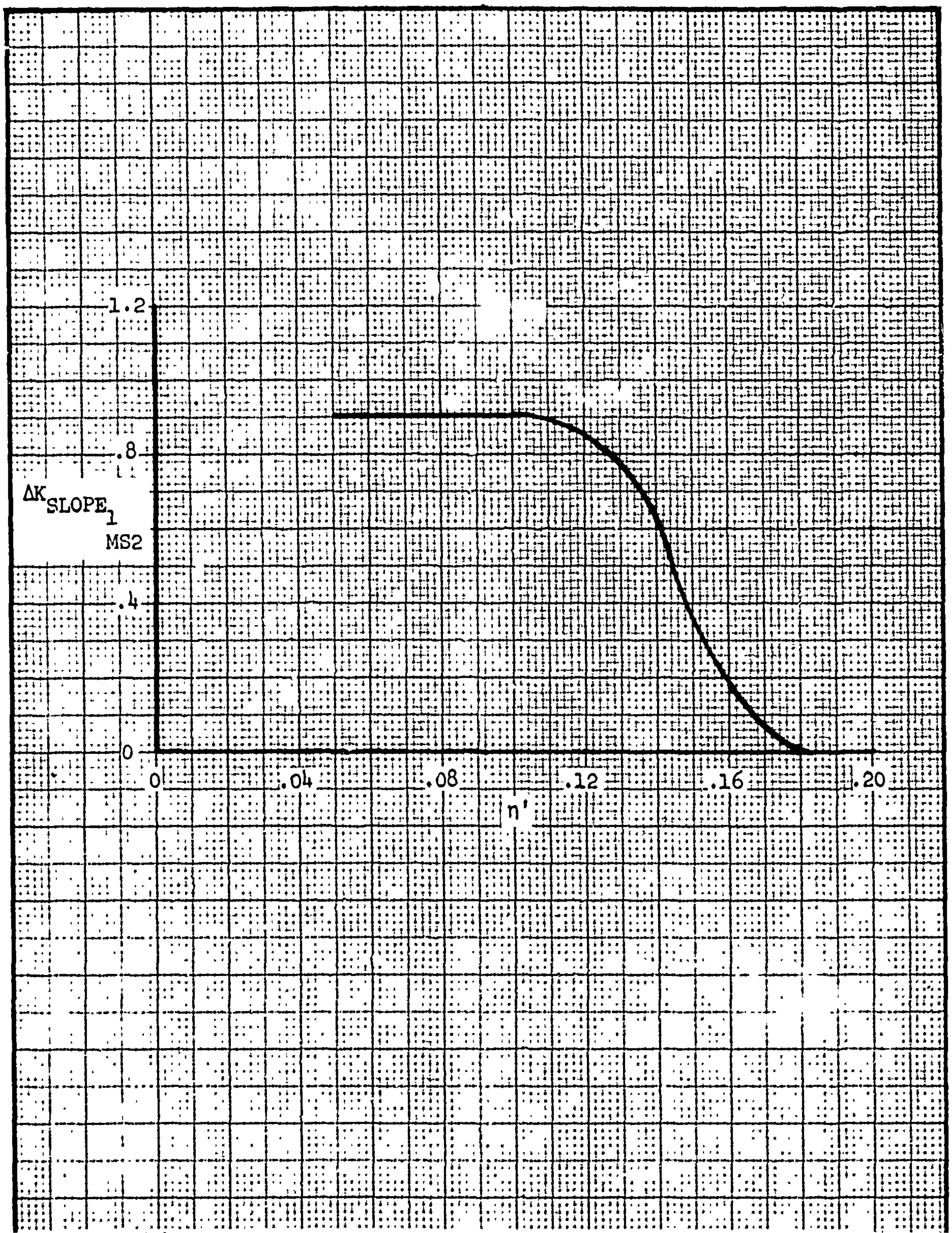



Figure 467. Yawing Moment Intercept - $K_{SLOPE_1}$ Fuselage Interference Correction for MER Station 2

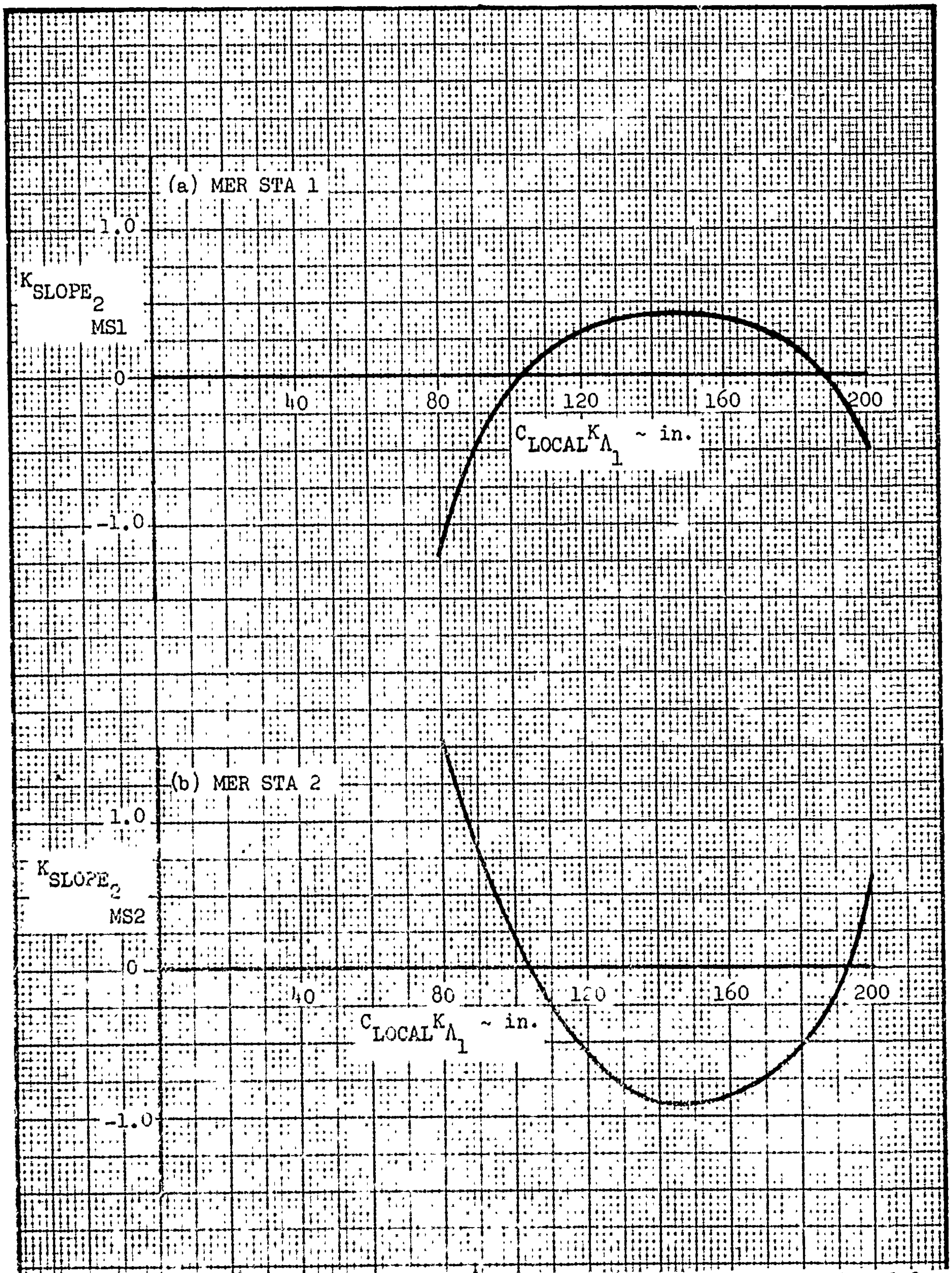



Figure 468. Yawing Moment Intercept - $K_{SLOPE_2}$ for MER Stations 1 and 2

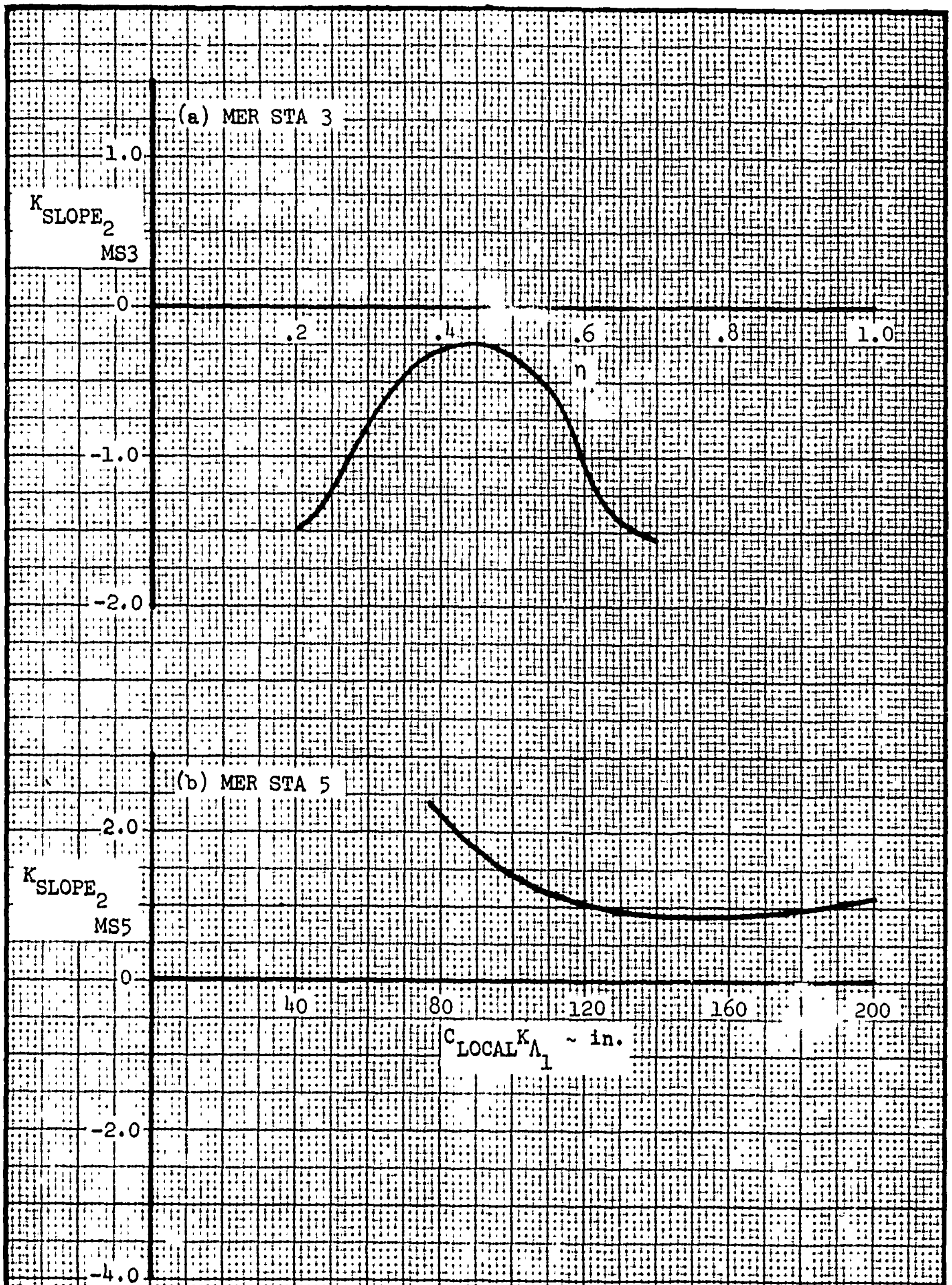



Figure 469. Yawing Moment Intercept - $K_{SLOPE_2}$ for MER Stations 3 and 5

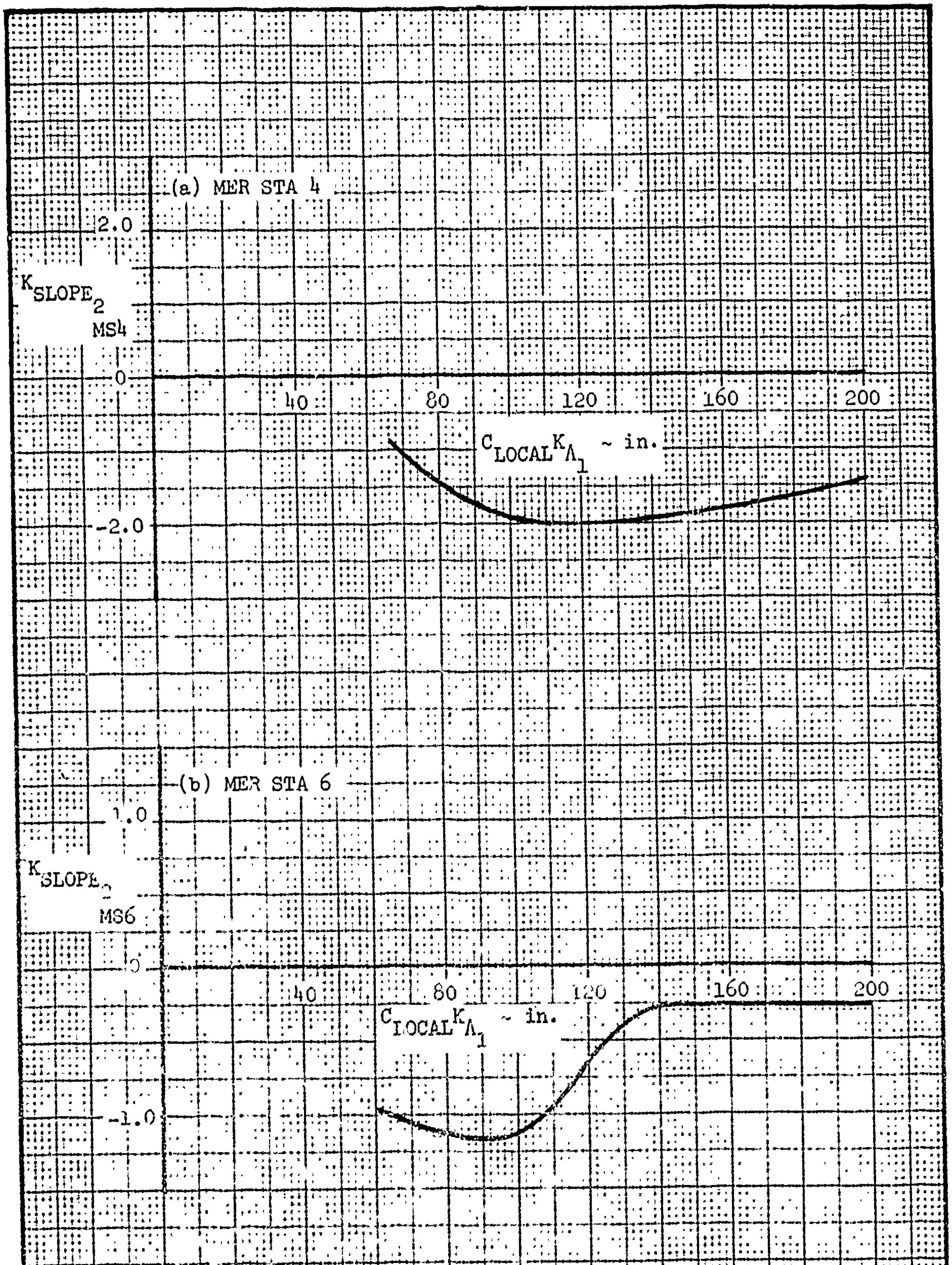



Figure 570. Yawing Moment Intercept - $K_{SLOPE_2}$ for MER Stations 4 and 6

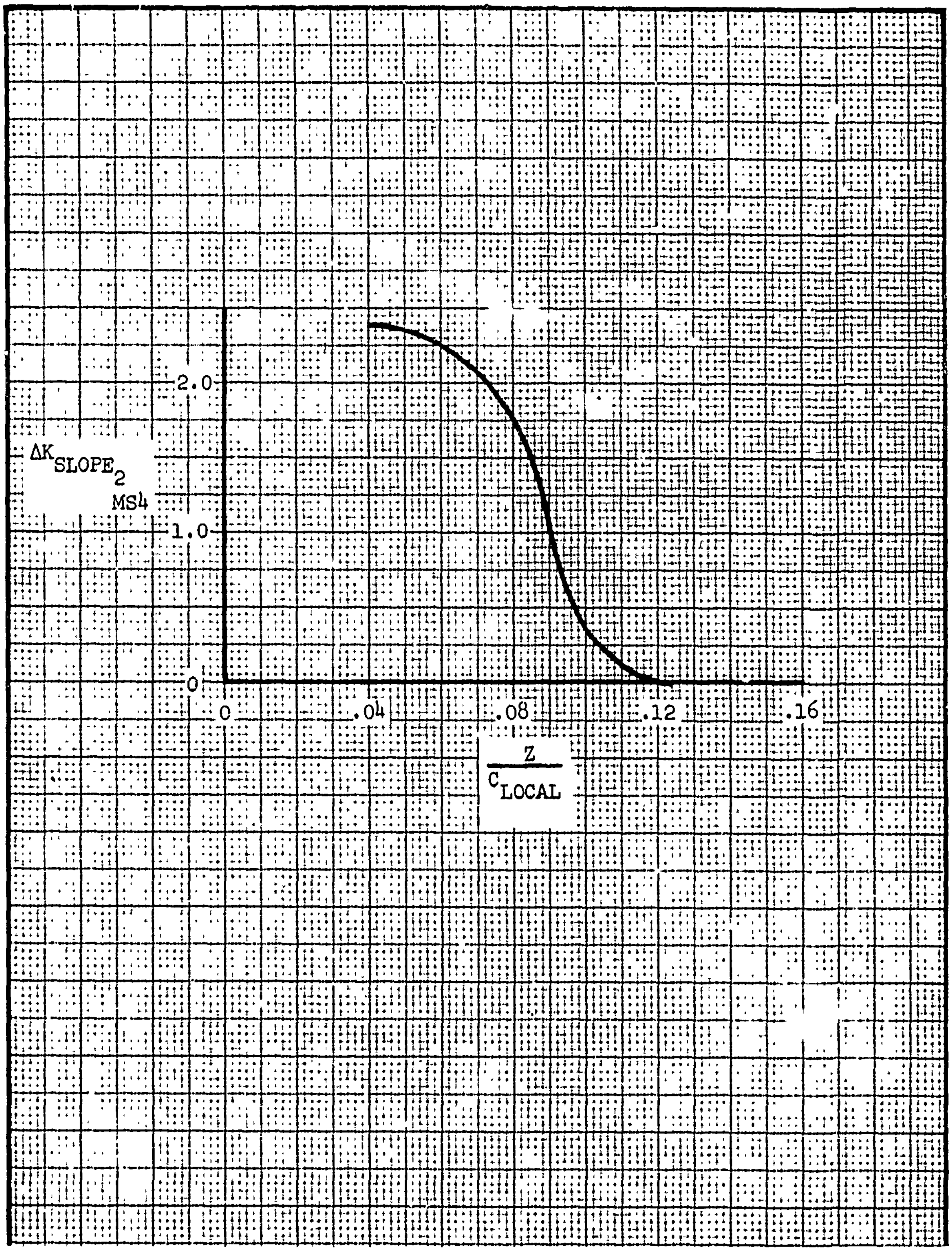



Figure 471. Yawing Moment Intercept - $K_{SLOPE_2}$ Pylon Height Correction for MER Station 4

### 4.2.2 Increment Aircraft Yaw

The captive store incremental yawing moment due to aircraft yaw is obtained as the difference between the yawed pitch polar and the zero-yaw pitch polar data as outlined in Section III. The incremental yawing moment slope, $\Delta\left(\frac{YM}{q}\right)_{\alpha}$, and intercept, $\Delta\left(\frac{YM}{q}\right)_{\alpha=0}$, thus obtained are linear with aircraft yaw angle; therefore, the incremental slope and intercept equations are derived and presented per degree of store yaw angle, $\beta$. The incremental airloads due to aircraft yaw are referenced to the coordinate system presented in Subsection 2.3.1.2.

To compute the incremental yawing moment slope, $\Delta\left(\frac{YM}{q}\right)_{\alpha}$, the following equation is used.

$$\Delta\left(\frac{YM}{q}\right)_{\alpha} = \Delta\left(\frac{YM}{q}\right)_{\alpha_{\beta}} \cdot \beta$$

where:

$\Delta\left(\frac{YM}{q}\right)_{\alpha_{\beta}}$ - Incremental yawing moment slope per degree $\beta$ as obtained by the methods presented in the following sections, $\frac{ft^3}{deg^2}$

$\beta$ - Store yaw angle, deg., equal to $+\Psi_{A/C}$ for right wing store installations or $-\Psi_{A/C}$ for left wing store installations.

The equation and procedure for computing the incremental yawing moment intercept, $\Delta\left(\frac{YM}{q}\right)_{\alpha=0}$, due to aircraft yaw is similar to the above presentation for incremental yawing moment slope.

#### 4.2.2.1 Slope Prediction

The incremental yawing slope prediction is divided into two sections, fuselage centerline-mounted stores and wing-mounted stores. The technique presented in this section covers the Mach number range 0.5 to 1.6.

## FUSELAGE CENTERLINE-MOUNTED STORES

MER STATIONS 1 - 6 (MS1-6):

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{\beta_{\text{℄}}}} = \Delta C_{n_{\alpha_{\beta_{\text{℄}}}}}{}_{MS1-6}\; K_{SCALE_{YM}}$$

where:

$\Delta C_{n_{\alpha_{\beta_{\text{℄}}}}}$ - Variation of $C_{n_{\alpha_\beta}}$ presented as a function of Mach number, $\frac{1}{deg^2}$.

MER STA 1 - Figure 472

MER STA 2 - Figure 473

MER STA 3 - Figure 472

MER STA 4 - Figure 473

MER STA 5 - Figure 472

MER STA 6 - Figure 473

$K_{SCALE_{YM}}$ - Defined in Section IV, $ft^3$.

## WING-MOUNTED STORES

MER STATIONS 1, 3, and 5 (MS1,3,5):

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{\beta}}{}_{MS1,3,5} = \left(\Delta C_{n_{\alpha_\beta}}{}_{MS1,3,5} + K_{\frac{\ell_{LE_A}}{C}} \Delta C_{n_{\alpha_{\beta_{\frac{\ell_{LE_A}}{C}}}}}\right) K_{SCALE_{YM}} \Lambda_1$$

where:

$\Delta C_{n_{\alpha_\beta}}$ - Incremental $C_{n_\alpha}$ per degree $\beta$ presented as a function of wing spanwise position for Mach numbers 0.7, 0.9, 1.05, 1.2, and 1.6, $\frac{1}{deg^2}$, Table 11.

$K_{\frac{\ell_{LE_A}}{C}}$ - Proportioning factor based on the distance from the wing leading edge to the nose of the store on MER STATION 1 measured in the wing plan view divided by the local wing chord, positive, Figure 485.

$\Delta C_{n_{\alpha_{\beta_{\frac{\ell_{LE_A}}{C}}}}}$ - Incremental $C_{n_\alpha}$ per degree $\beta$ based on $\ell_{LE_A}/C$ defined above and presented as a function of Mach number, $\frac{1}{deg^2}$.

MER STA 1 - Figure 484

MER STA 3 - Figure 484

MER STA 5 - Figure 484

$K_{SCALE_{YM}}$ - Defined in Section IV, $ft^3$.

$K_{\Lambda_1}$ - Wing sweep correction factor, $\frac{\sin \Lambda}{\sin 45^\circ}$, where $\Lambda$ is the quarter chord sweep of the aircraft wing.

MER STATIONS 2,4,and 6 (MS2,4,6):

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{\beta_{MS2,4,6}}} = \Delta C_{n_{\alpha_{\beta_{MS2,4,6}}}} K_{SCALE_{YM}} K_{\Lambda_1}$$

where:

$\Delta C_{n_{\alpha_\beta}}$ - Incremental $C_{n_\alpha}$ per degree $\beta$ presented as a function of wing spanwise position for Mach numbers 0.7, 0.9, 1.05, 1.2 and 1.6, $\frac{1}{deg^2}$, Table 11.

$K_{SCALE_{YM}}$ - Defined in Section IV, $ft^3$.

$K_{\Lambda_1}$ - Defined in MS1,3,5 above.

The variation of $\Delta C_{n_{\alpha_\beta}}$ for MER STATIONS 1-6 is presented at distinct Mach numbers of 0.7, 0.9, 1.05, 1.2, and 1.6. Table 11 presented below is a guide for locating the curves for $\Delta C_{n_{\alpha_\beta}}$ for each MER station at the Mach numbers indicated above. For Mach numbers between 0.5 and 0.7, the value at M = 0.7 should be used in the computation. For Mach numbers between 0.7 and 1.6 other than those distinctly presented, linear interpolation should be used between the appropriate Mach numbers to obtain the required value for computation.

TABLE 11. INCREMENTAL YAWING MOMENT SLOPE COEFFICIENT DUE TO YAW - FIGURE LOCATION GUIDE

| $\Delta C_{n_{\alpha_\beta}}$ | MACH NUMBER 0.7 | 0.9 | 1.05 | 1.2 | 1.6 |
|---|---|---|---|---|---|
| | Figure Numbers | | | | |
| MER STA 1 | 474 | 476 | 478 | 480 | 482 |
| MER STA 2 | 475 | 477 | 479 | 481 | 483 |
| MER STA 3 | 474 | 476 | 478 | 480 | 482 |
| MER STA 4 | 475 | 477 | 479 | 481 | 483 |
| MER STA 5 | 474 | 476 | 478 | 480 | 482 |
| MER STA 6 | 475 | 477 | 479 | 481 | 483 |

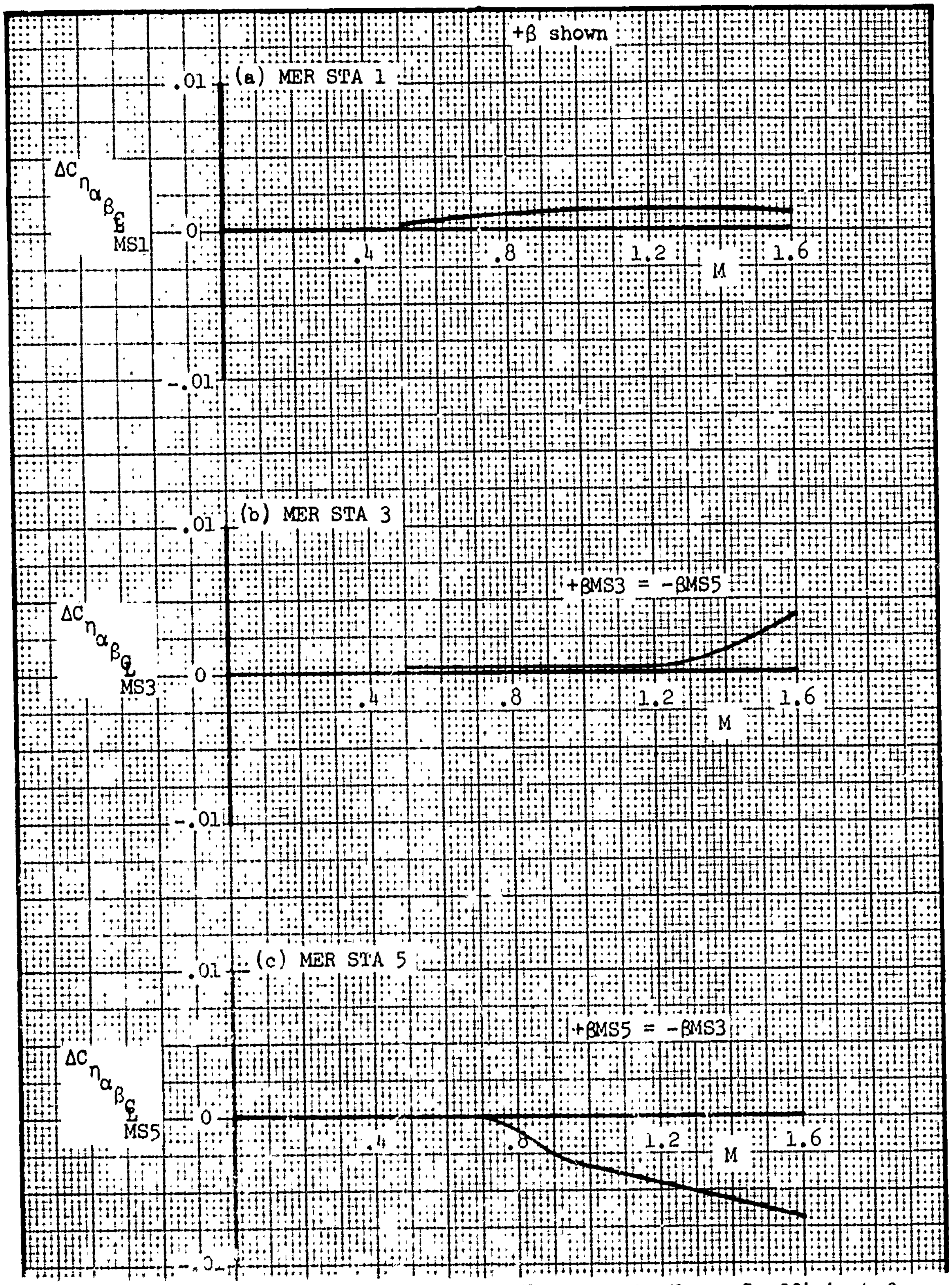



Figure 172. Incremental Yawing Moment Slope Due to Yaw - Coefficient for Stores Mounted on Fuselage Centerline, MER Stations 1,3 and 5

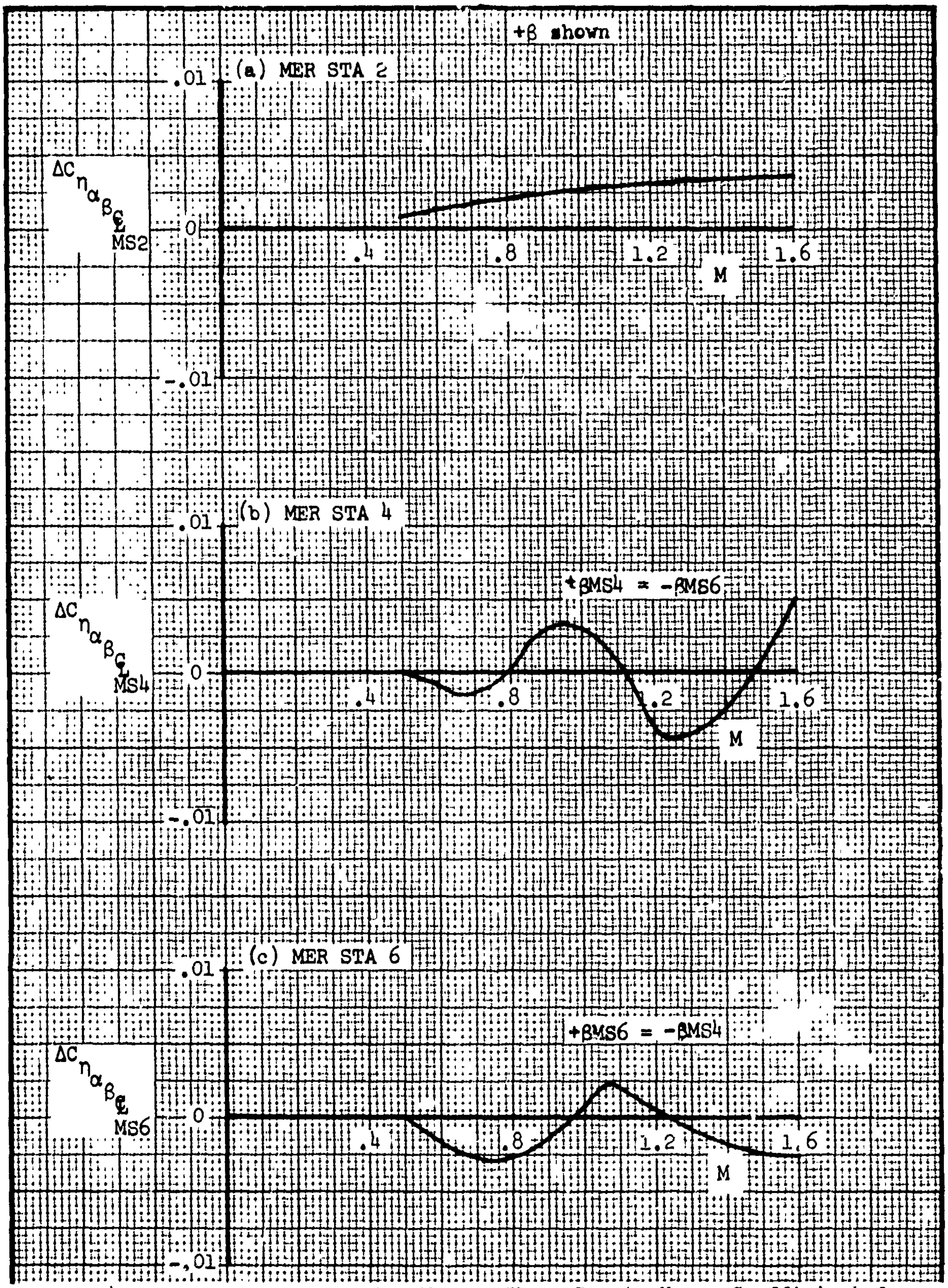



Figure 473. Incremental Yawing Moment Slope Due to Yaw - Coefficient for Stores Mounted on Fuselage Centerline, MER Stations 2, 4 and 6

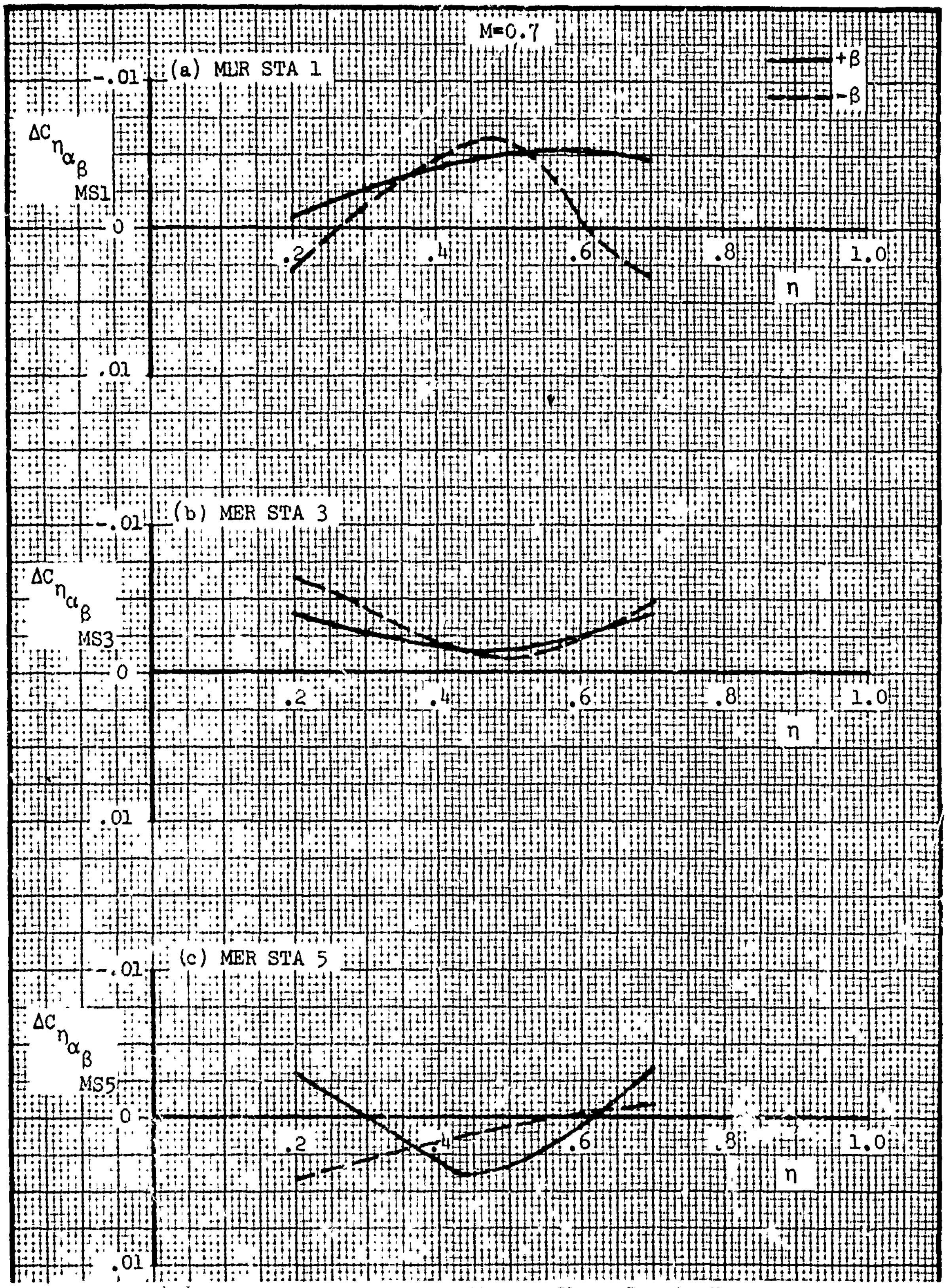



Figure 474. Incremental Yawing Moment Slope Due to Yaw - Spanwise Correction at M = 0.7 for MER Stations 1, 3 and 5

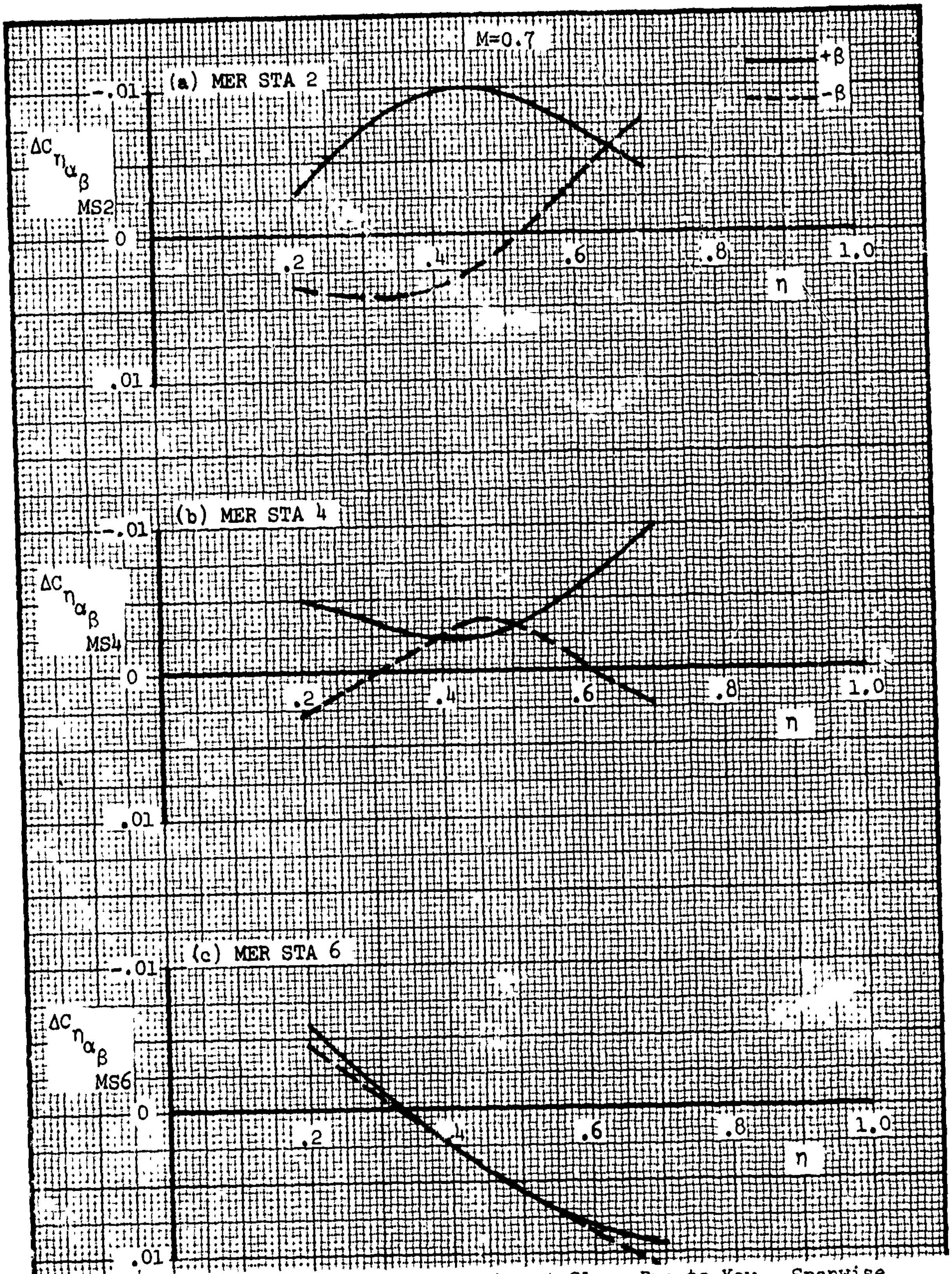



Figure 475. Incremental Yawing Moment Slope Due to Yaw - Spanwise Correction at M = 0.7 for MER Stations 2, 4, and 6

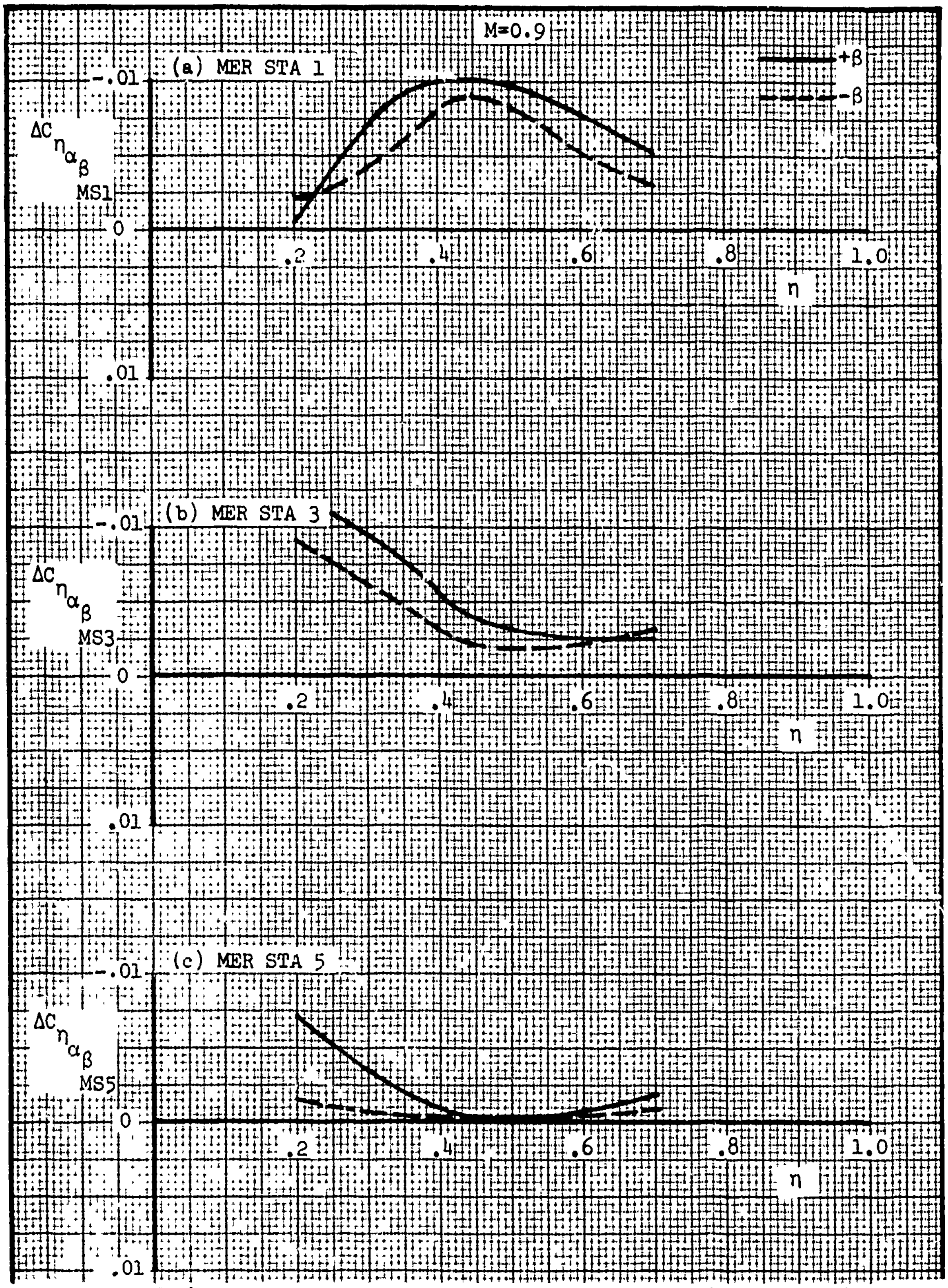



Figure 476. Incremental Yawing Moment Slope Due to Yaw - Spanwise Correction at M = 0.9 for MER Stations 1, 3, and 5

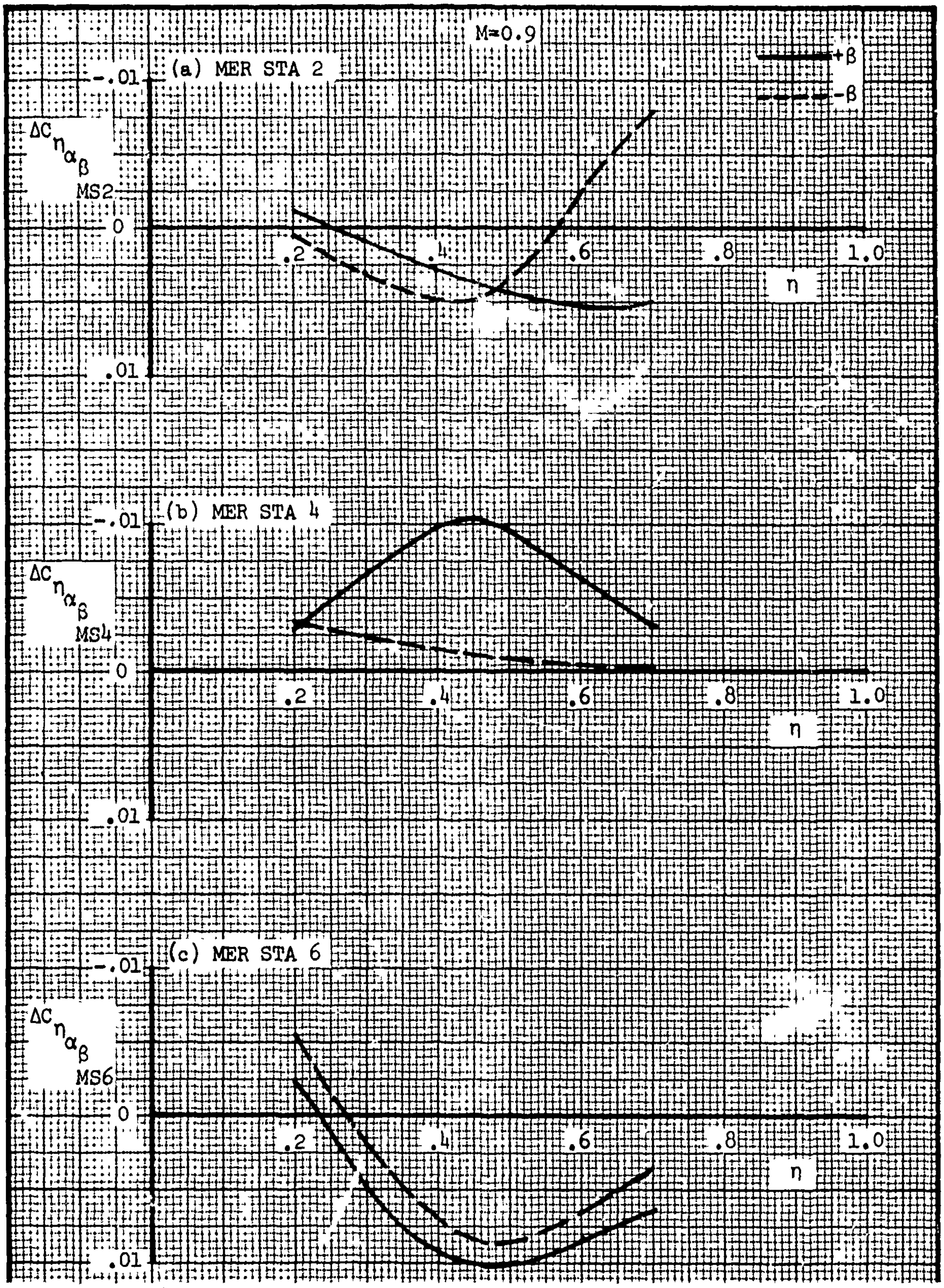



Figure 477. Incremental Yawing Moment Slope Due to Yaw - Spanwise Correction at M=0.9 for MER Stations 2,4, and 6

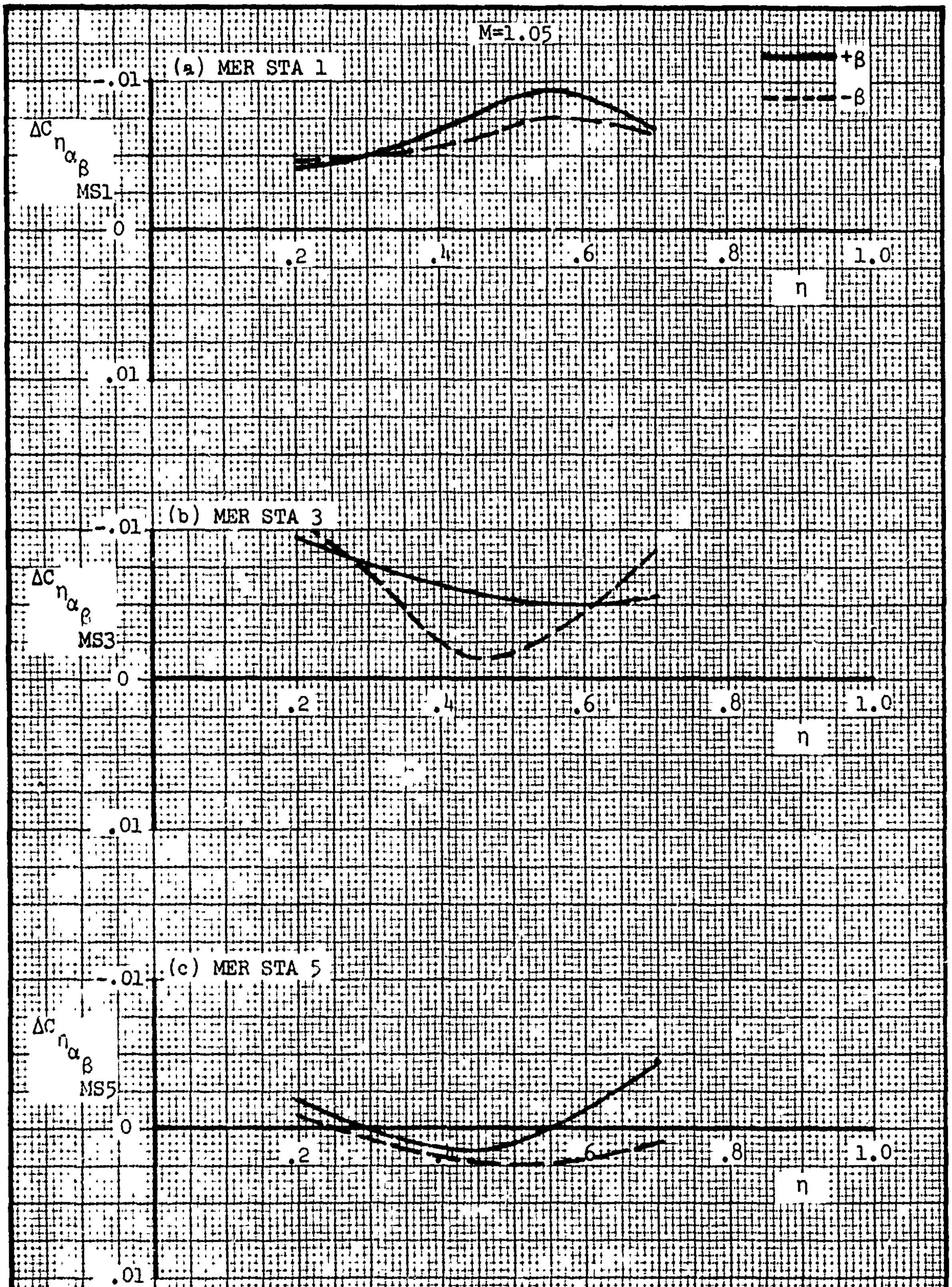



Figure 47?. Incremental Yawing Moment Slope Due to Yaw - Spanwise Correction at M = 1.05 for MER Stations 1,3 and 5

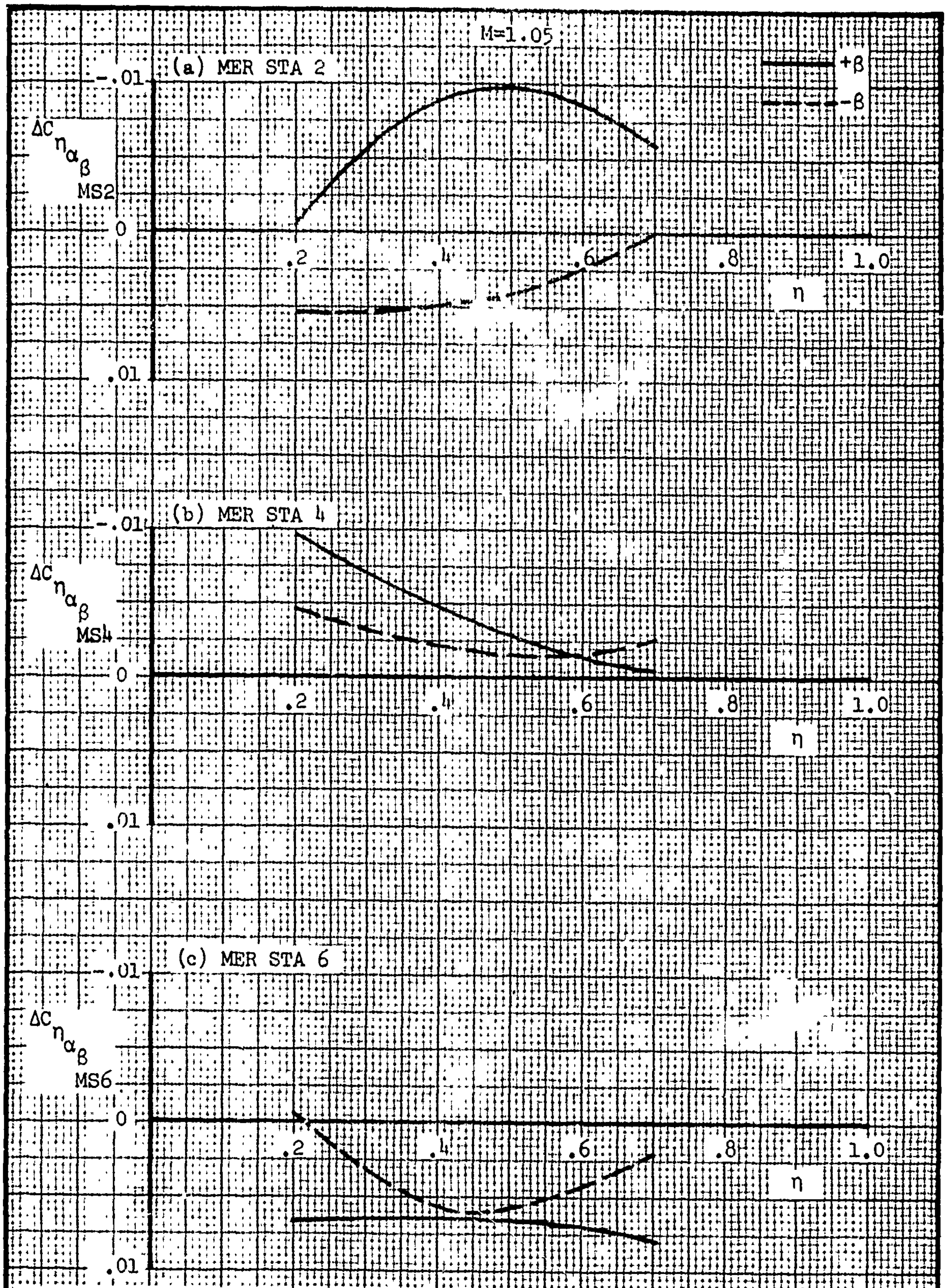



Figure 479. Incremental Yawing Moment Slope Due to Yaw - Spanwise Correction at M = 1.05 for MER Stations 2, 4 and 6

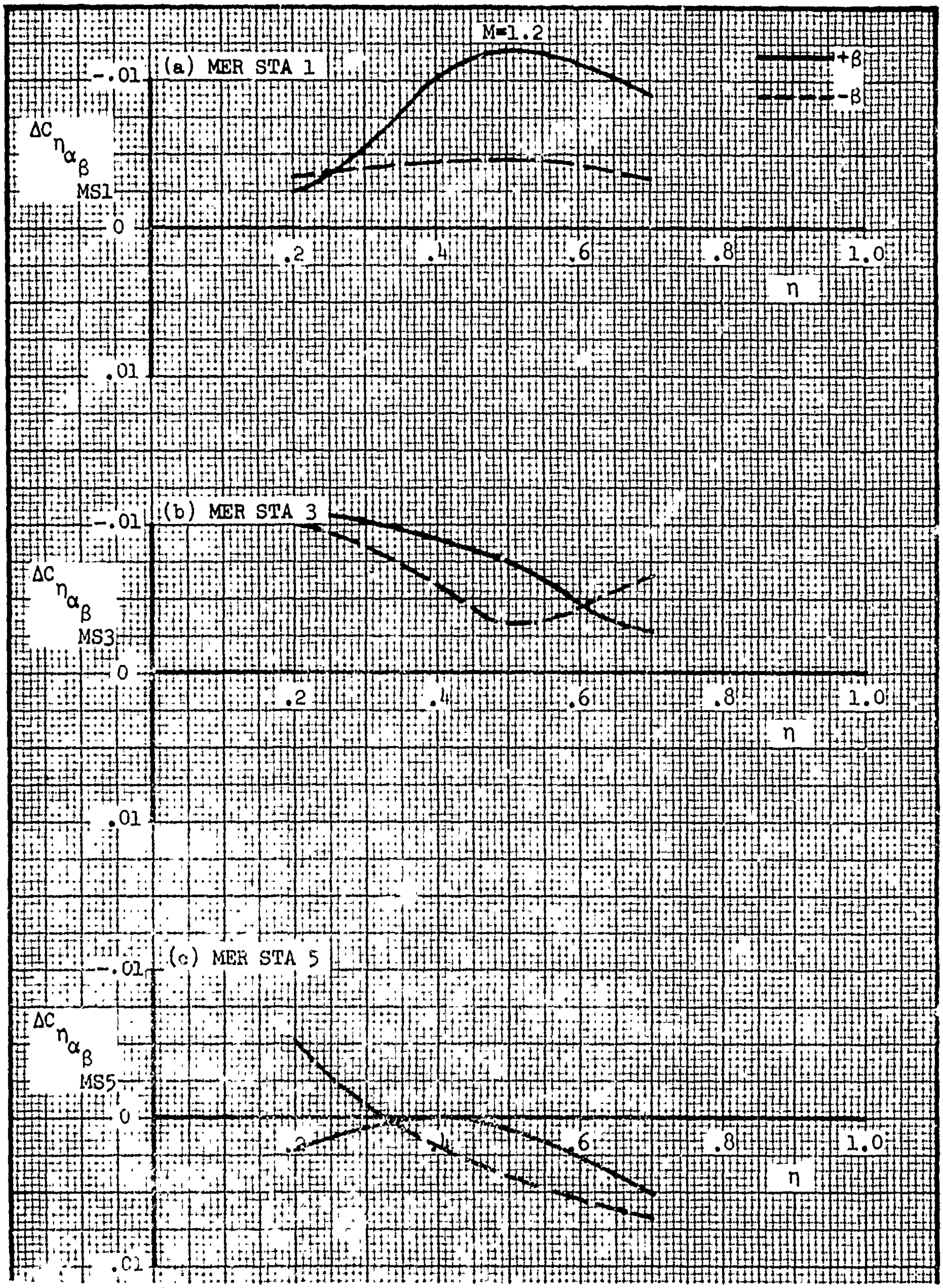



Figure 480. Incremental Yawing Moment Slope Due to Yaw - Spanwise Correction at M = 1.2 for MER Stations 1, 3 and 5

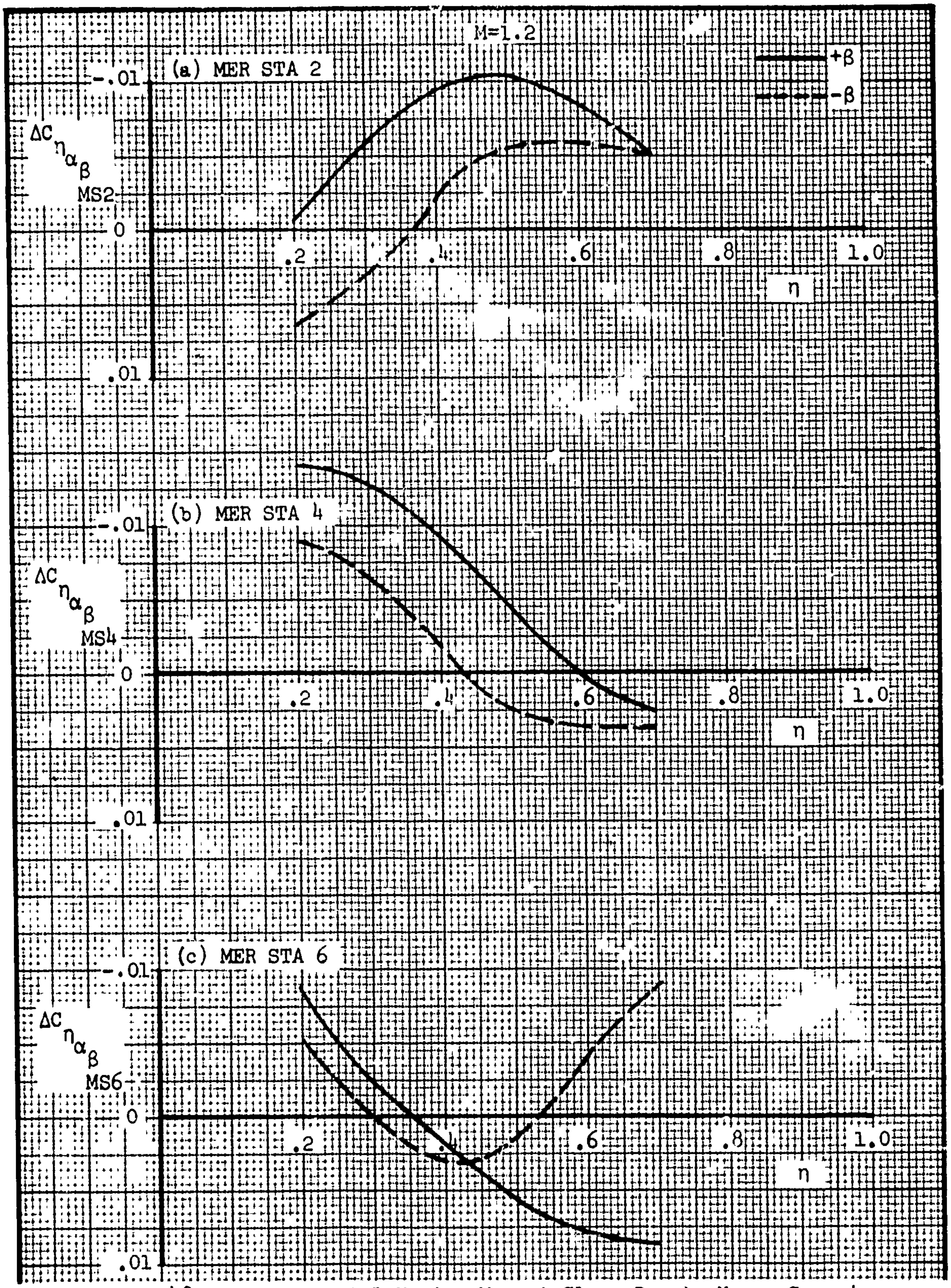



Figure 481. Incremental Yawing Moment Slope Due to Yaw - Spanwise Correction at M = 1.2 for MER Stations 2, 4 and 6

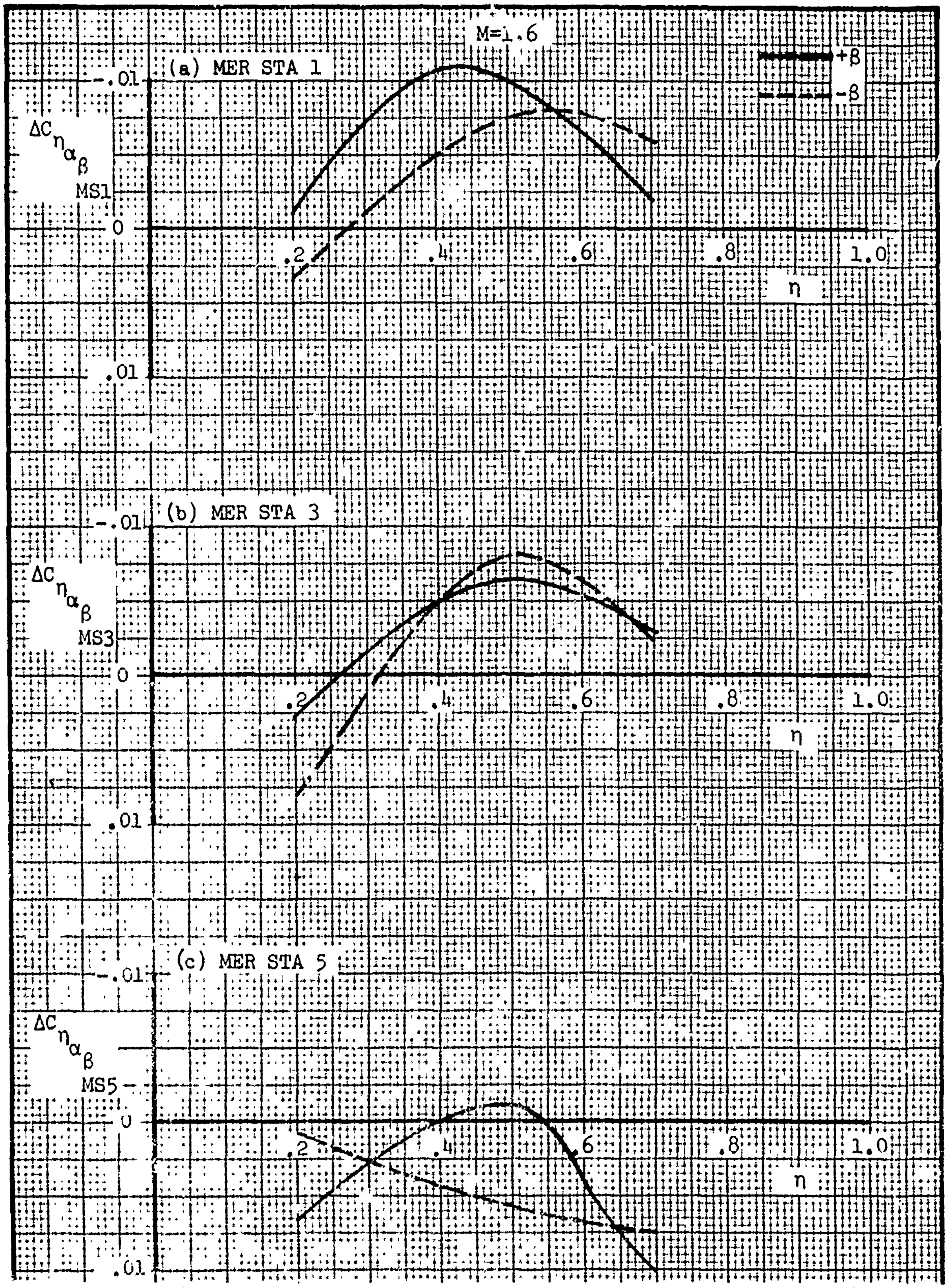



Figure 482. Incremental Yawing Moment Slope Due to Yaw - Spanwise Correction at M = 1.6 for MER Stations 1, 3 and 5

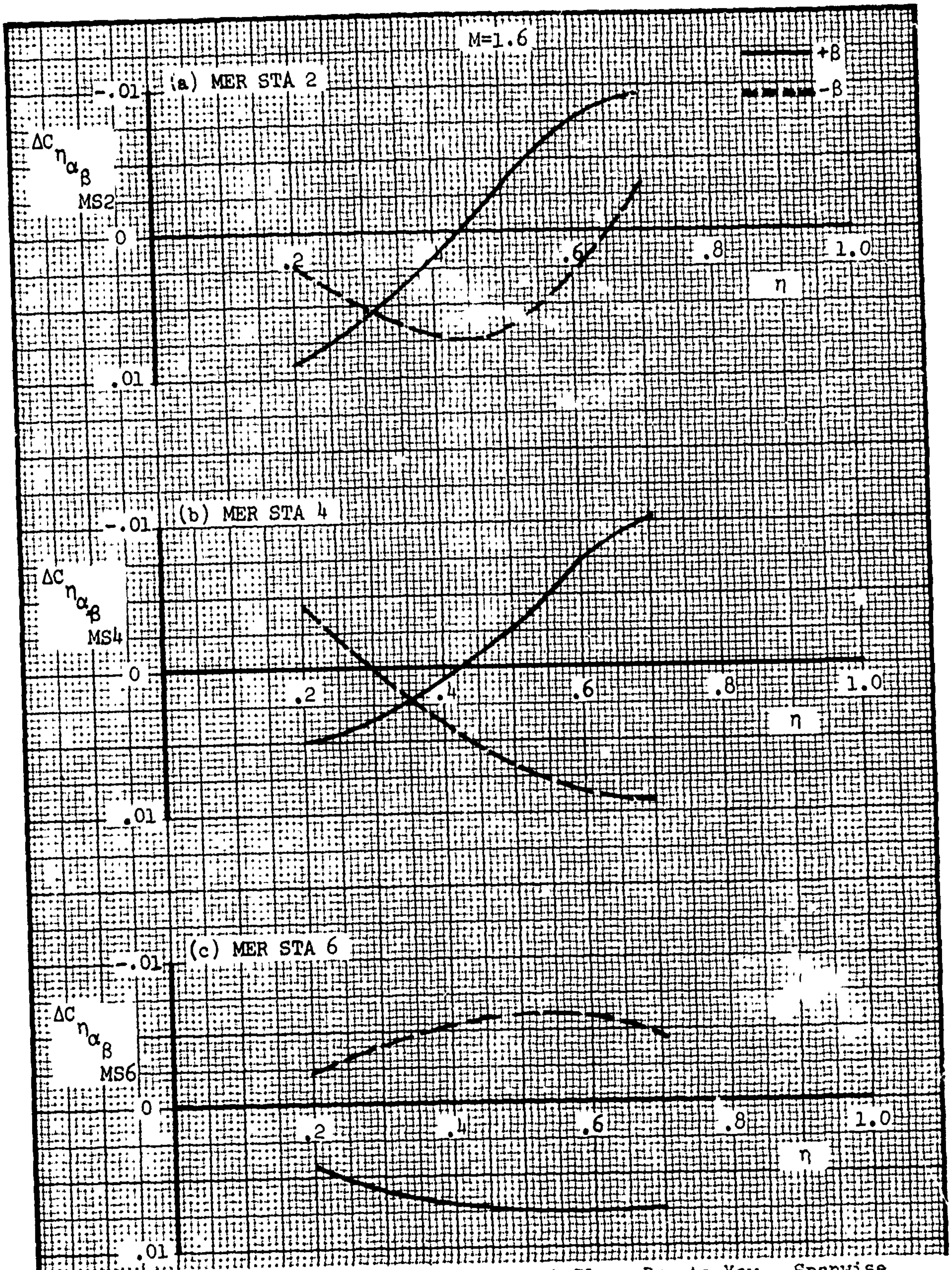



Figure 483. Incremental Yawing Moment Slope Due to Yaw - Spanwise Correction at M = 1.6 for MER Stations 2,4,and 6

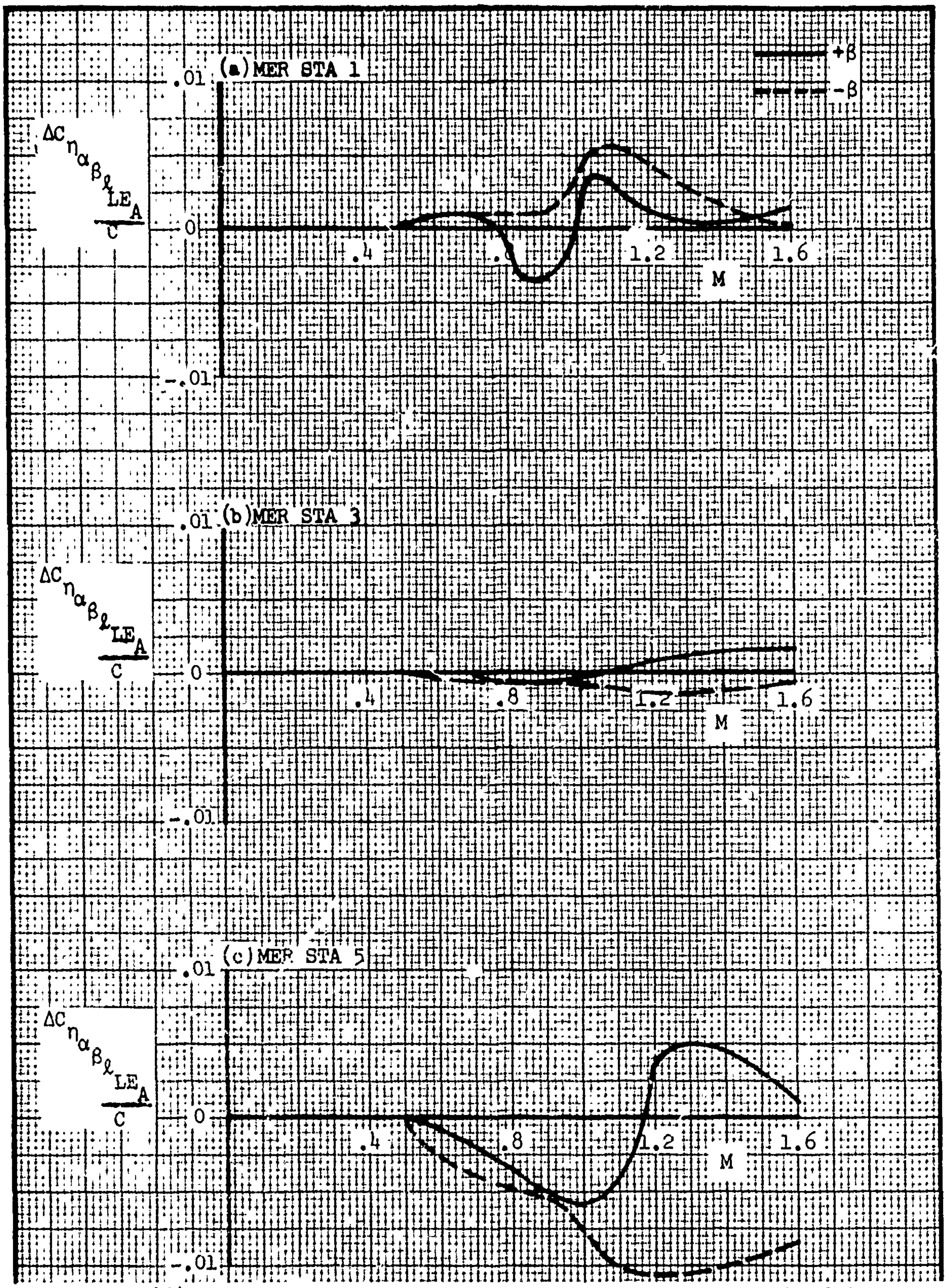



Figure 484. Incremental Yawing Moment Slope Due to Yaw - Chordwise Correction for MER Stations 1, 3 and 5

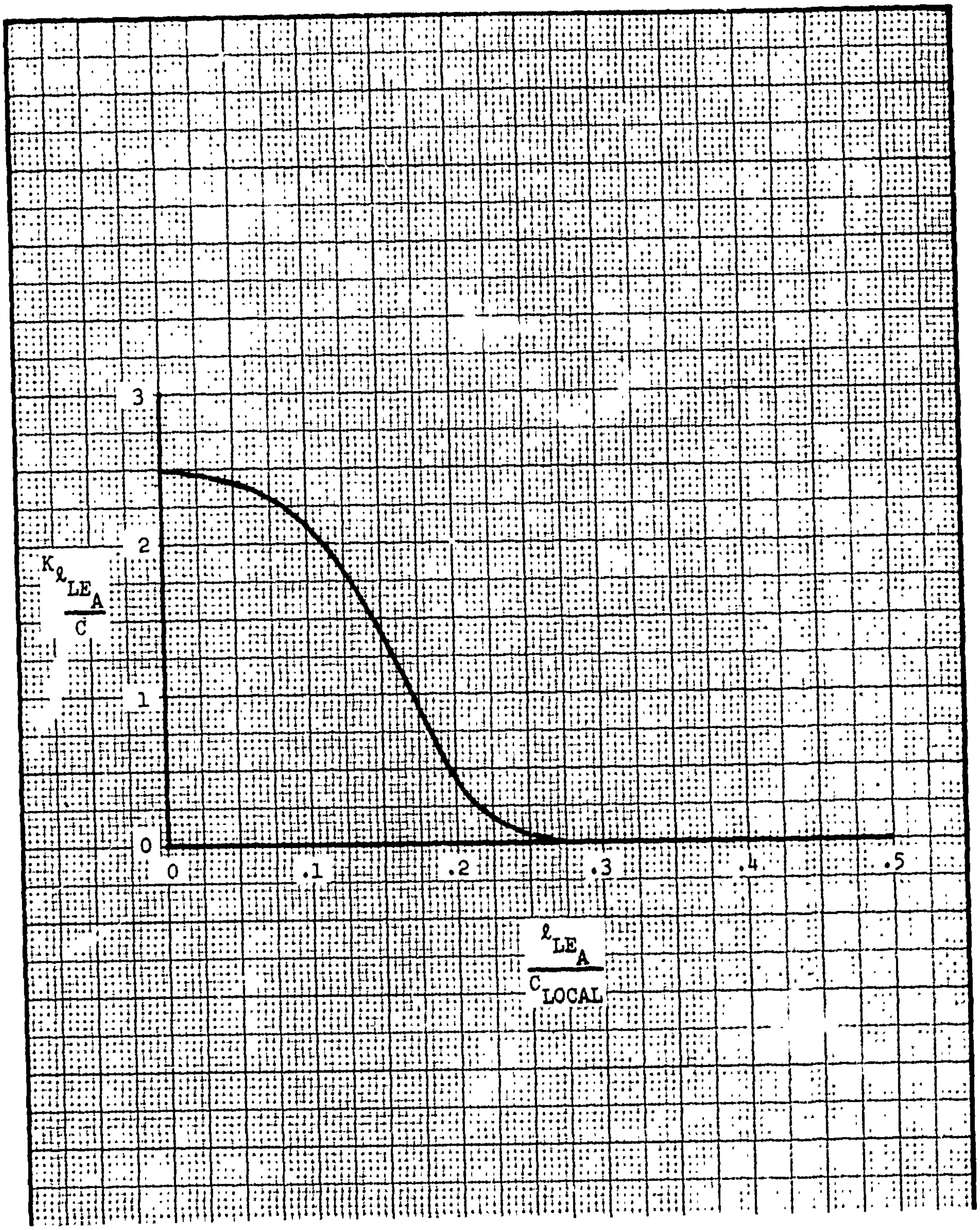



Figure 485. Incremental Yawing Moment Slope Due to Yaw - Chordwise Correction Factor

4.2.2.2 Intercept Prediction

The incremental yawing moment intercept prediction is divided into two sections, fuselage centerline-mounted stores and wing-mounted stores. The technique presented in this section covers the Mach number range 0.5 to 1.6.

FUSELAGE CENTERLINE-MOUNTED STORES

MER STATIONS 1-6 (MS1-6):

$$\Delta\left(\frac{YM}{q}\right)_{\alpha=0_{\beta_{\mathcal{L}}}} = \Delta C_{n_{\alpha=0_{\beta_{\mathcal{L}}}}{}_{MS1-6}} K_{SCALE_{YM}}$$

where:

$\Delta C_{n_{\alpha=0_{\beta_{\mathcal{L}}}}}$ - Variation of $C_{n_{\alpha=0_{\beta}}}$ presented as a function of Mach number, $\frac{1}{deg.}$.

MER STA 1 - Figure 486
MER STA 2 - Figure 487
MER STA 3 - Figure 486
MER STA 4 - Figure 487
MER STA 5 - Figure 486
MER STA 6 - Figure 487

$K_{SCALE_{YM}}$ - Defined in Section IV, $ft^3$.

WING-MOUNTED STORES

MER STATIONS 1, 3, and 5 (MS1,3,5):

$$\Delta\left(\frac{YM}{q}\right)_{\alpha=0_{\beta}{}_{MS1,3,5}} = \left(\Delta C_{n_{\alpha=0_{\beta}}{}_{MS1,3,5}} + K_{\ell_{\frac{LE_A}{C}}} \Delta C_{n_{\alpha=0_{\beta_{\ell_{\frac{LE_A}{C}}}}}}\right) K_{SCALE_{YM}} K_{\Lambda_1}$$

where:

$\Delta C_{n_{\alpha=0_\beta}}$ - Incremental $C_{n_{\alpha=0}}$ per degree β presented as a function of wing spanwise position for Mach numbers 0.7, 0.9, 1.05, 1.2, and 1.6, $\frac{1}{deg}$, Table 12.

$K_{\frac{\ell_{LE_A}}{C}}$ - Proportioning factor based on the distance from the wing leading edge to the nose of the store on MER STATION 1 measured in the wing plan view divided by the local wing chord, positive, Figure 485, Subsection 4.2.2.1.

$\Delta C_{n_{\alpha=0_{\beta_{\frac{\ell_{LE_A}}{C}}}}}$ - Incremental $C_{n_{\alpha=0}}$ per degree β based on $\ell_{LE_A}/C$ defined above and presented as a function of Mach number, $\frac{1}{deg}$.

MER STA 1 - Figure 498

MER STA 3 - Figure 498

MER STA 5 - Figure 498

$K_{SCALE_{YM}}$ - Defined in Section IV, $ft^3$.

$K_{\Lambda_1}$ - Wing sweep correction factor, $\frac{\sin \Lambda}{\sin 45°}$, where Λ is the quarter-chord sweep of the aircraft wing.

MER STATIONS 2, 4, and 6 (MS2,4,6):

$$\Delta\left(\frac{YM}{q}\right)_{\alpha=0_{\beta_{MS2,4,6}}} = \Delta C_{n_{\alpha=0_{\beta_{MS2,4,6}}}} K_{SCALE_{YM}} K_{\Lambda_1}$$

where:

$\Delta C_{n_{\alpha=0_{\beta}}}$ - Incremental $C_{n_{\alpha=0}}$ per degree β presented as a function of wing spanwise position for Mach numbers 0.7, 0.9, 1.05, 1.2, and 1.6, $\frac{1}{deg}$, Table 12.

$K_{SCALE_{YM}}$ - Defined in Section IV, $ft^3$.

$K_{\Lambda_1}$ - Defined in MS1,3,5 above.

The variation of $\Delta C_{n_{\alpha=0_{\beta}}}$ for MER STATIONS 1-6 is presented at distinct Mach numbers of 0.7, 0.9, 1.05, 1.2, and 1.6. Table 12 presented below is a guide for locating the curves for $\Delta C_{n_{\alpha=0_{\beta}}}$ for each MER station at the Mach numbers indicated above. For Mach numbers between 0.5 and 0.7, the value at M = 0.7 should be used in the computation. For Mach numbers between 0.7 and 1.6 other than those distinctly presented, linear interpolation should be used between the appropriate Mach numbers to obtain the required value for computation.

TABLE 12. INCREMENTAL YAWING MOMENT INTERCEPT COEFFICIENT DUE TO YAW - FIGURE LOCATION GUIDE

| $\Delta C_{n_{\alpha=0_{\beta}}}$ | MACH NUMBERS 0.7 | 0.9 | 1.05 | 1.2 | 1.6 |
|---|---|---|---|---|---|
| | Figure Numbers | | | | |
| MER STA 1 | 488 | 490 | 492 | 494 | 496 |
| MER STA 2 | 489 | 491 | 493 | 495 | 497 |
| MER STA 3 | 488 | 490 | 492 | 494 | 496 |
| MER STA 4 | 489 | 491 | 493 | 495 | 497 |
| MER STA 5 | 488 | 490 | 492 | 494 | 496 |
| MER STA 6 | 489 | 491 | 493 | 495 | 497 |

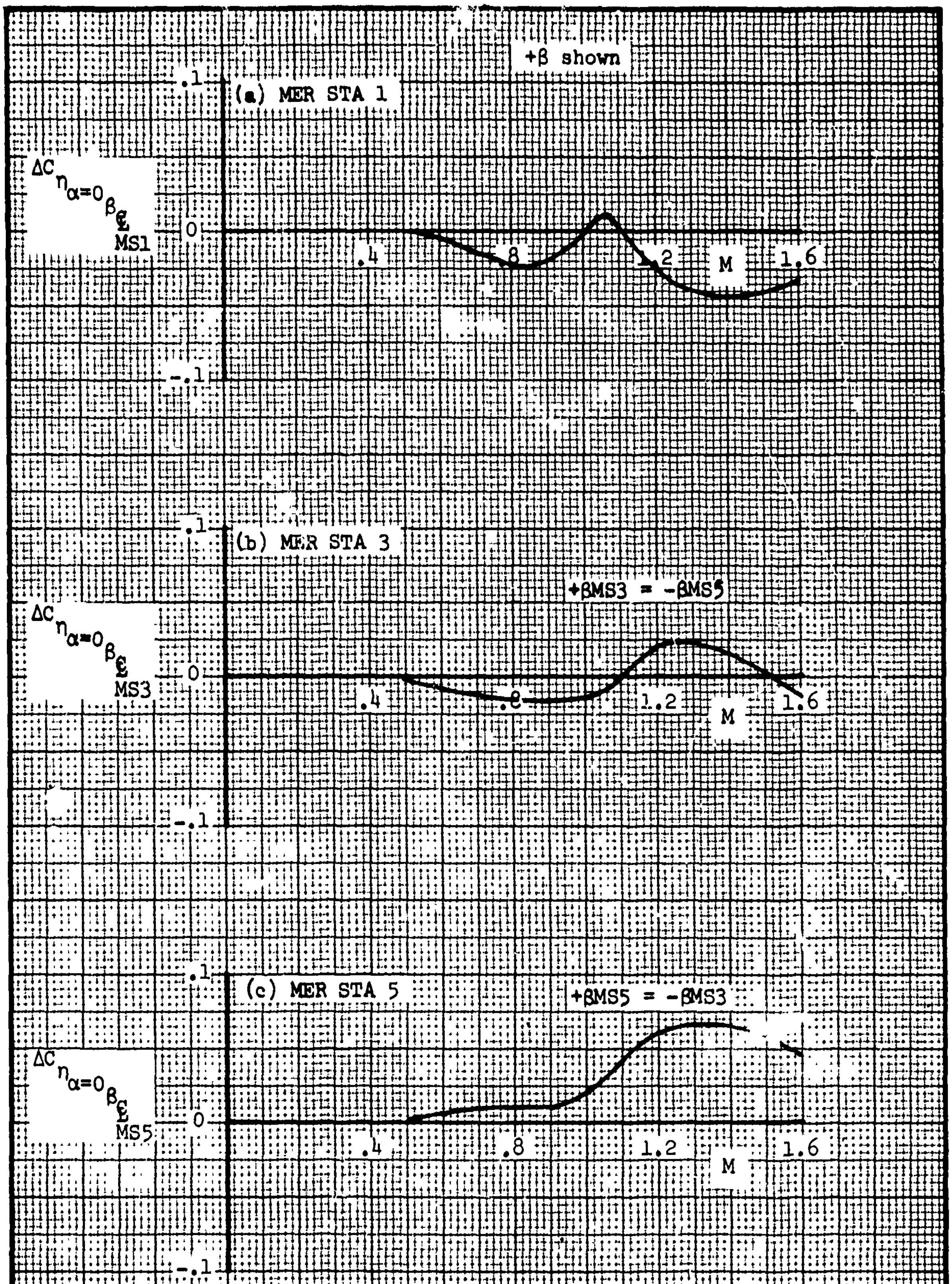



Figure 486. Incremental Yawing Moment Intercept Due to Yaw - Coefficient for Stores Mounted on Fuselage Centerline MER Stations 1,3, and 5

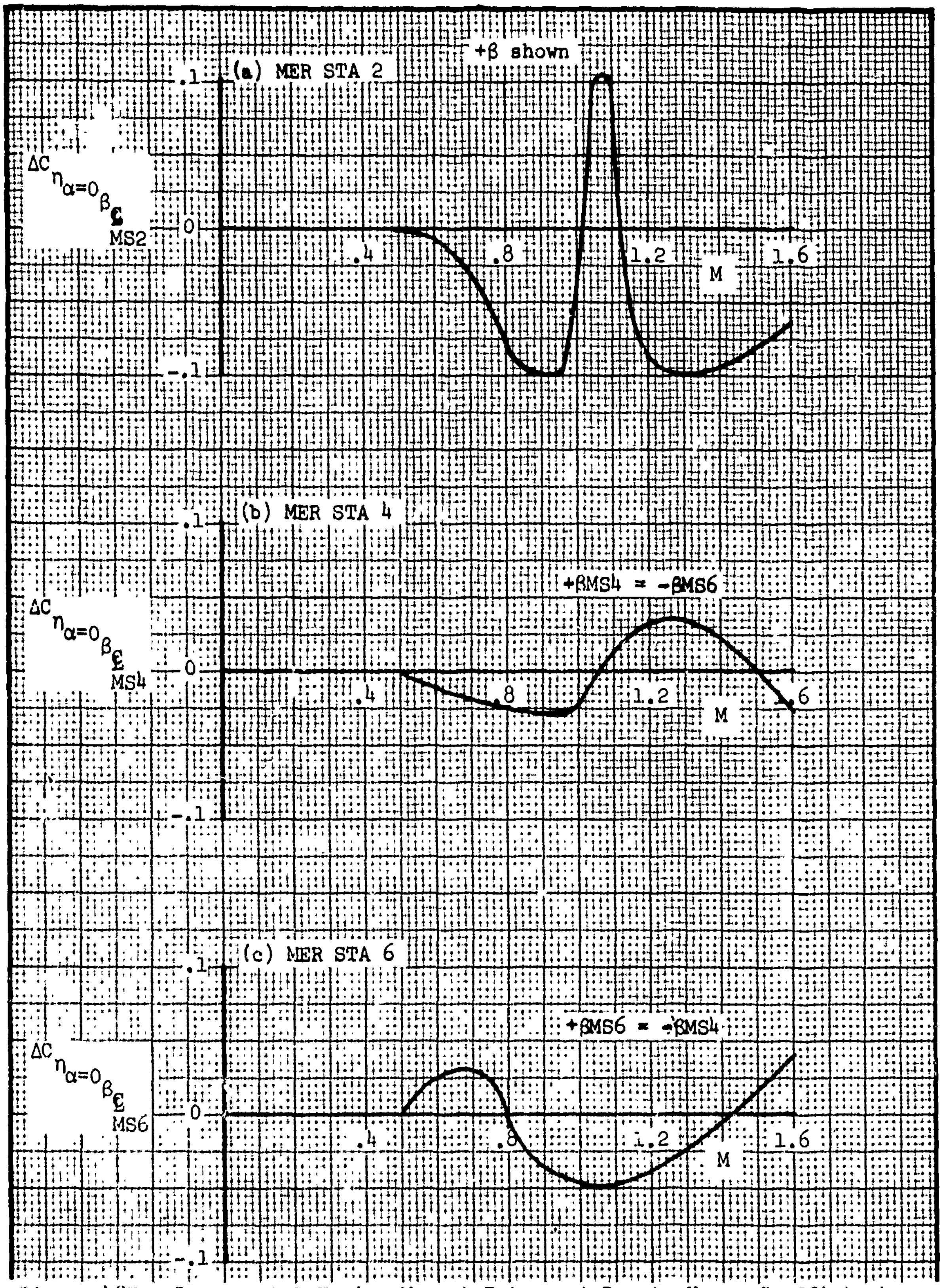



Figure 487. Incremental Yawing Moment Intercept Due to Yaw - Coefficient for Stores Mounted on Fuselage Centerline MER Stations 2,4, and 6

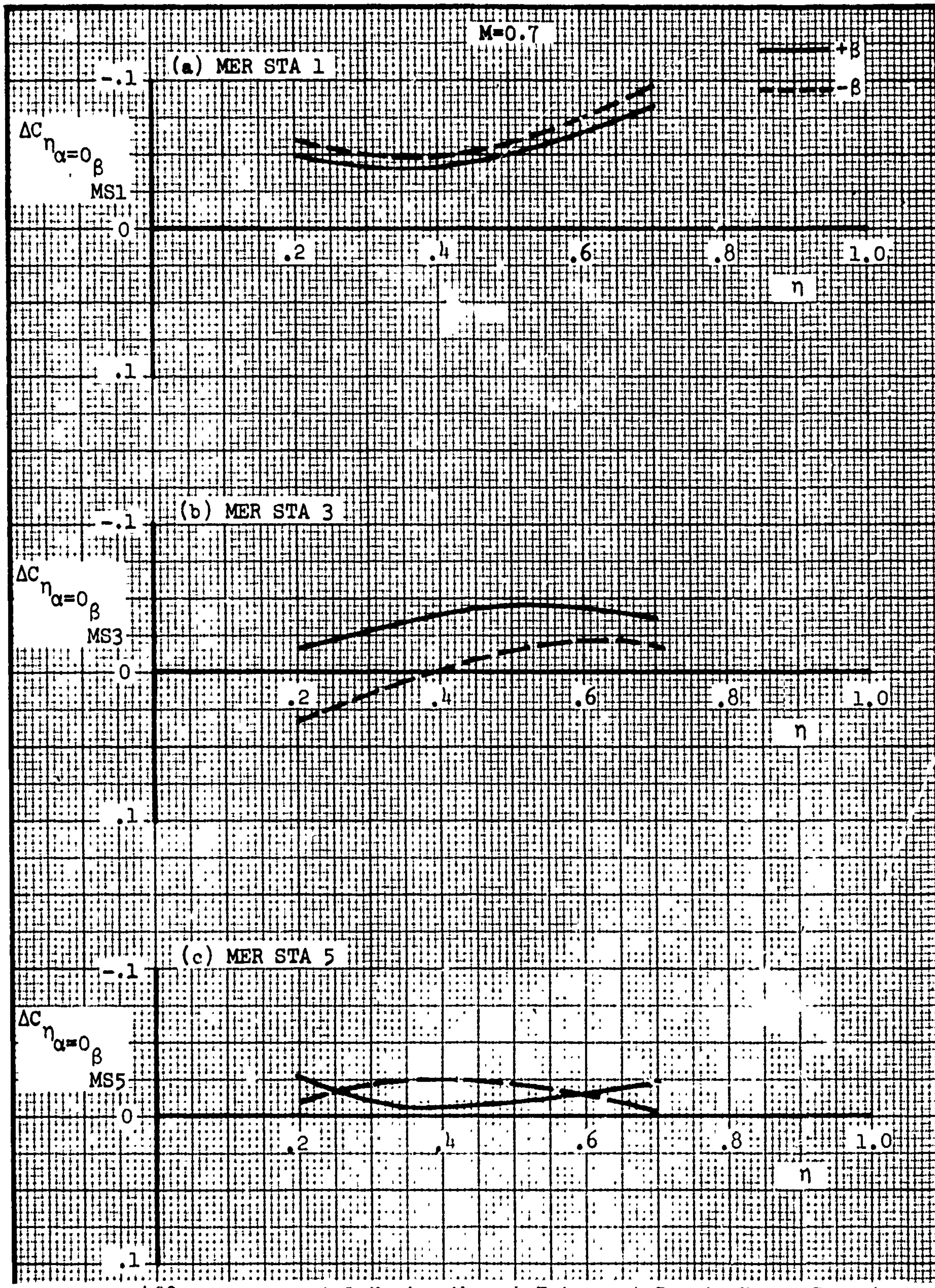



Figure 488. Incremental Yawing Moment Intercept Due to Yaw - Spanwise Correction at M = 0.7 for MER Stations 1, 3 and 5

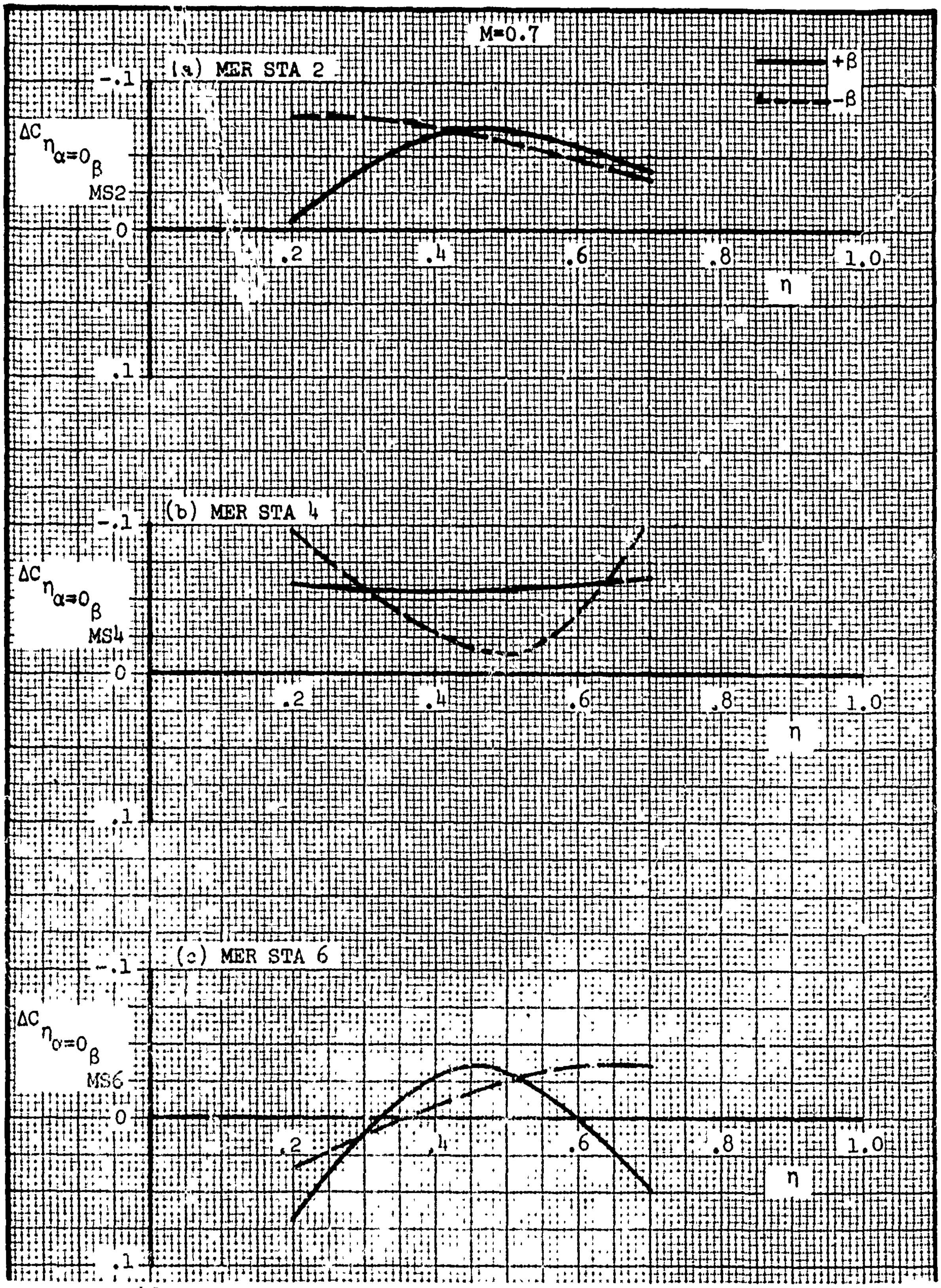



Figure 489. Incremental Yawing Moment Intercept Due to Yaw - Spanwise Correction at M = 0.7 for MER Stations 2, 4 and 6

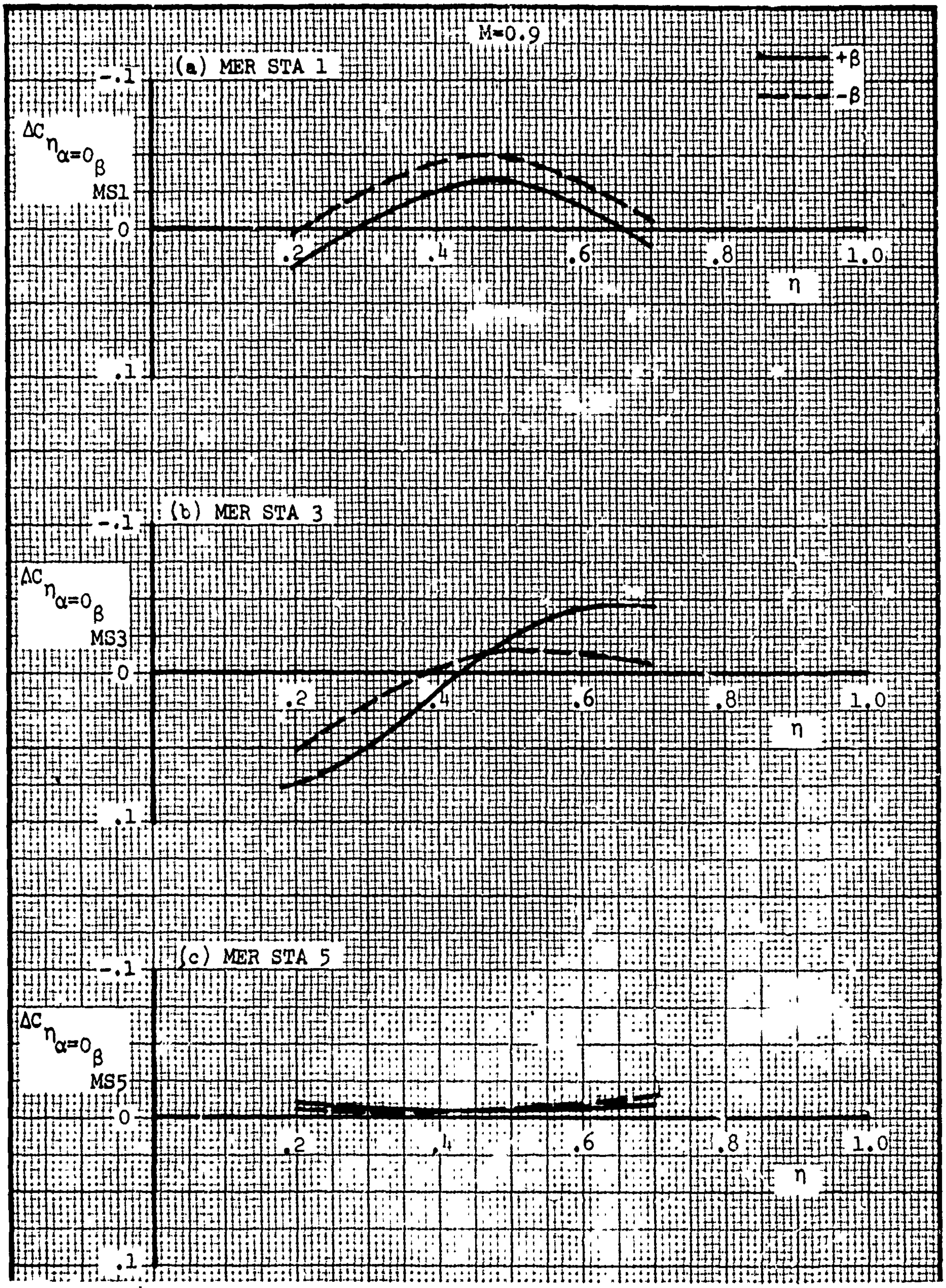



Figure 490. Incremental Yawing Moment Intercept Due to Yaw - Spanwise Correction at M = 0.9 for MER Stations 1, 3 and 5

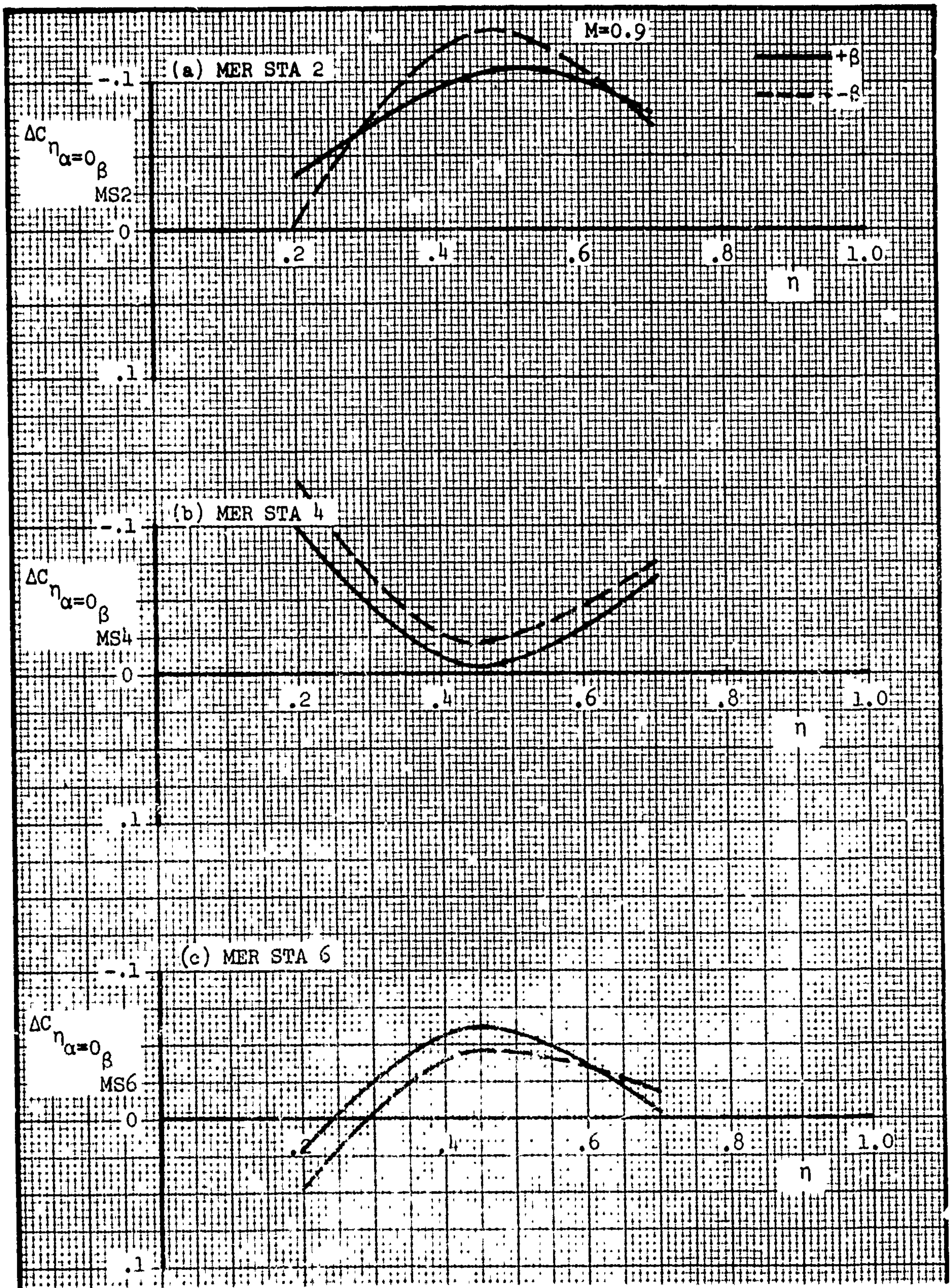



Figure 491. Incremental Yawing Moment Intercept Due to Yaw - Spanwise Correction at M = 0.9 for MER Stations 2, 4 and 6

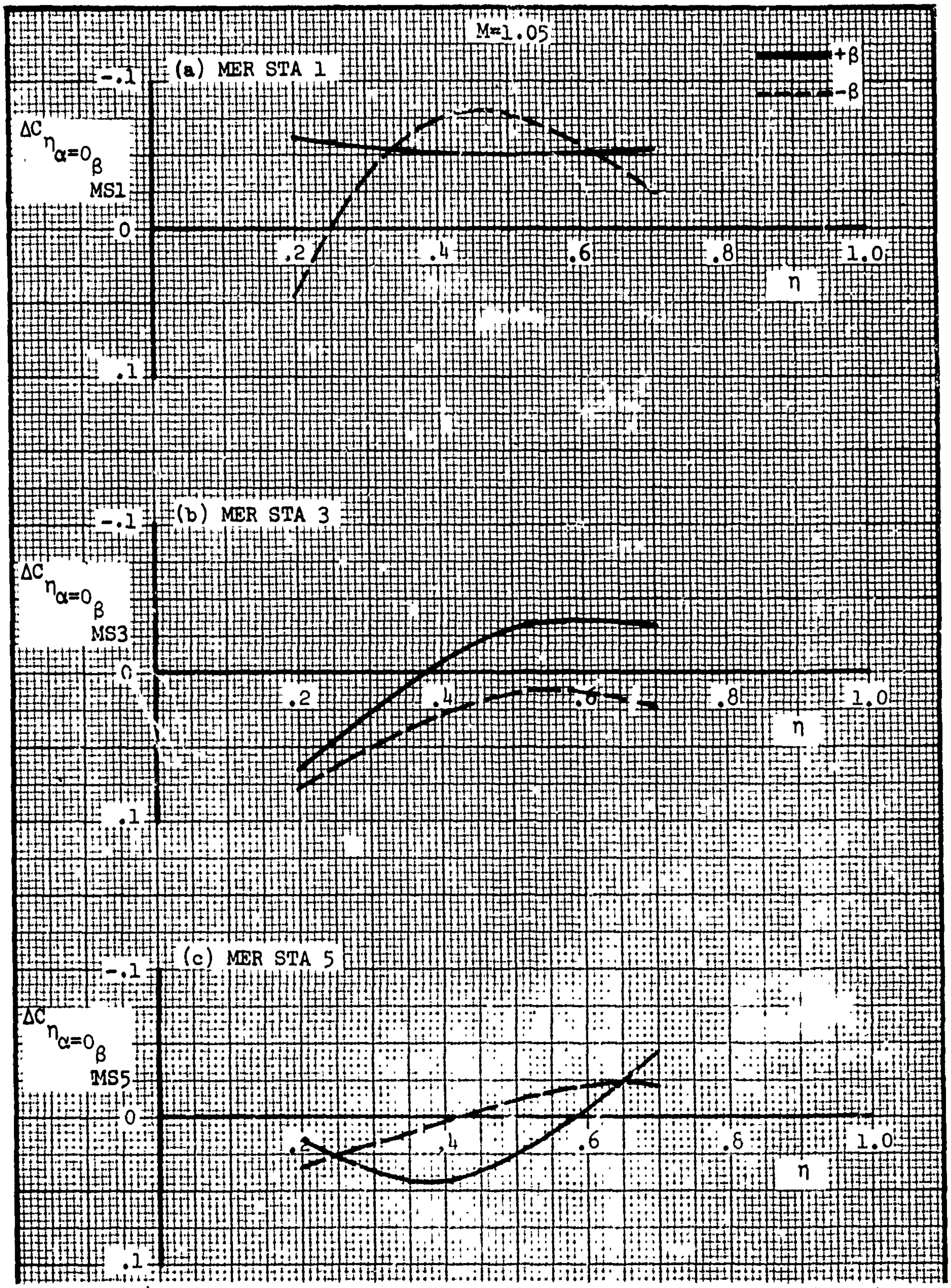



**Figure 492.** Incremental Yawing Moment Intercept Due to Yaw - Spanwise Correction at M = 1.05 for MER Stations 1, 3 and 5

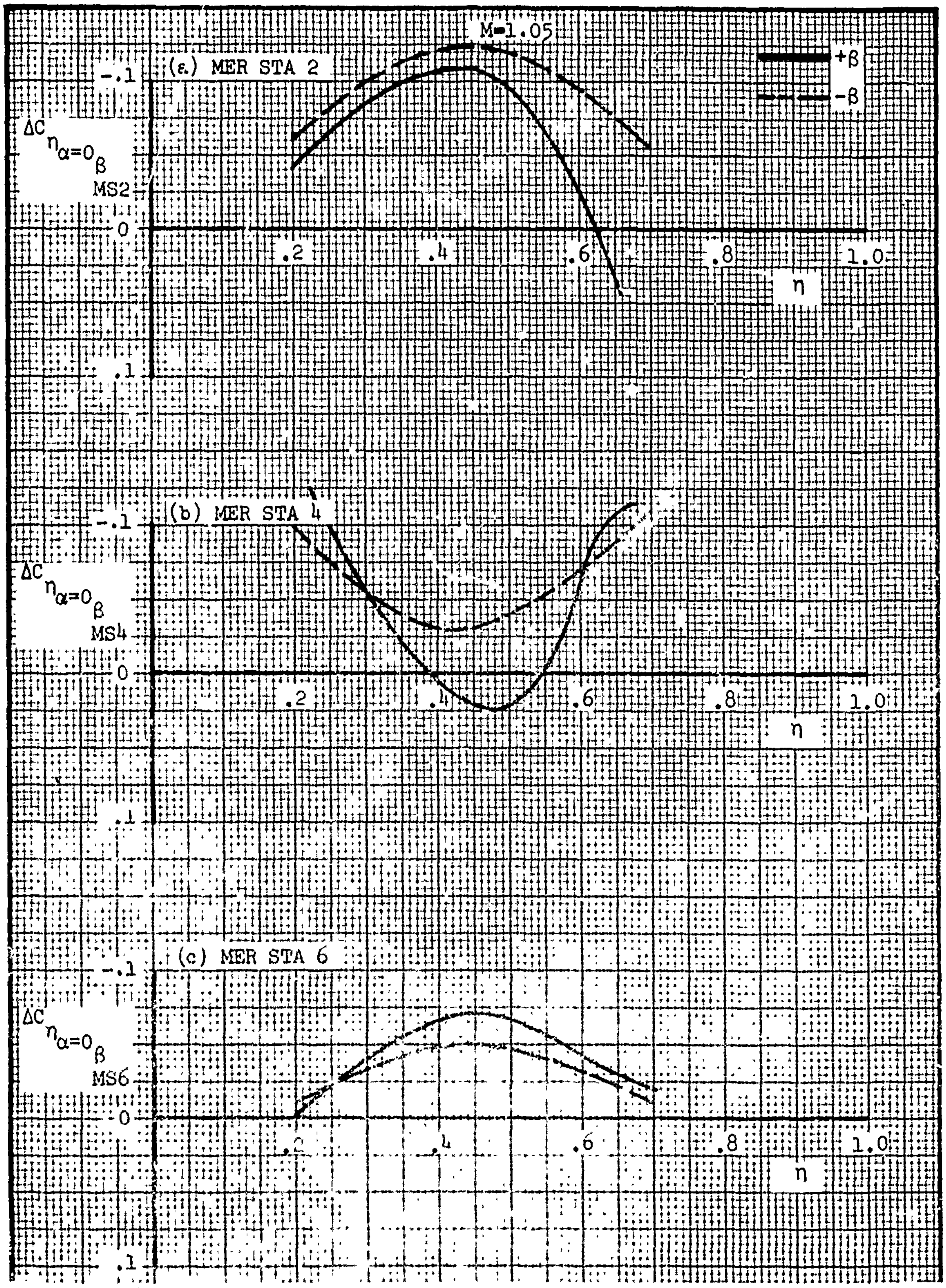



Figure 49c. Incremental Yawing Moment Intercept Due to Yaw - Spanwise Correction at M = 1.05 for MER Stations 2, 4 and 6

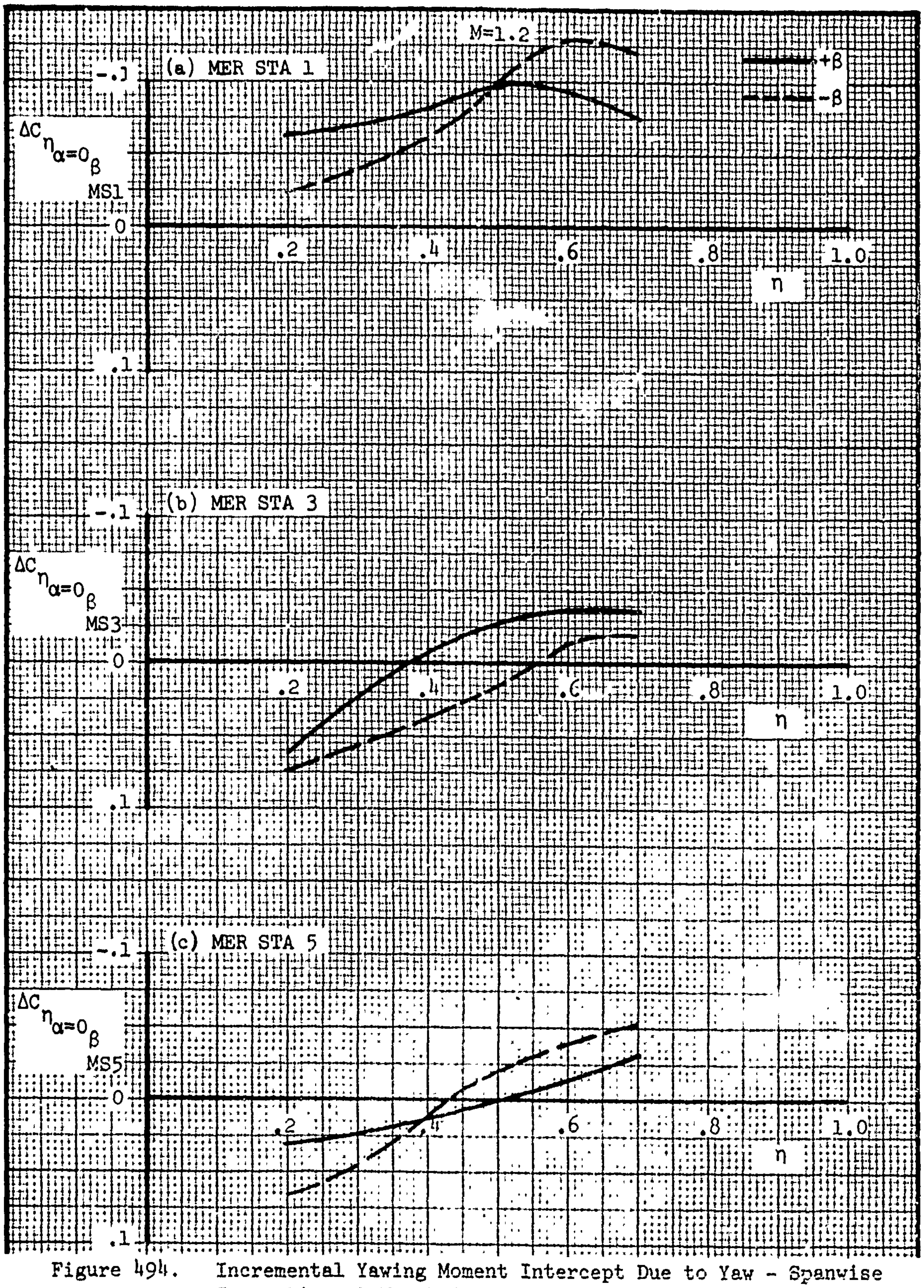



Figure 494. Incremental Yawing Moment Intercept Due to Yaw - Spanwise Correction at M = 1.2 for MER Stations 1, 3 and 5

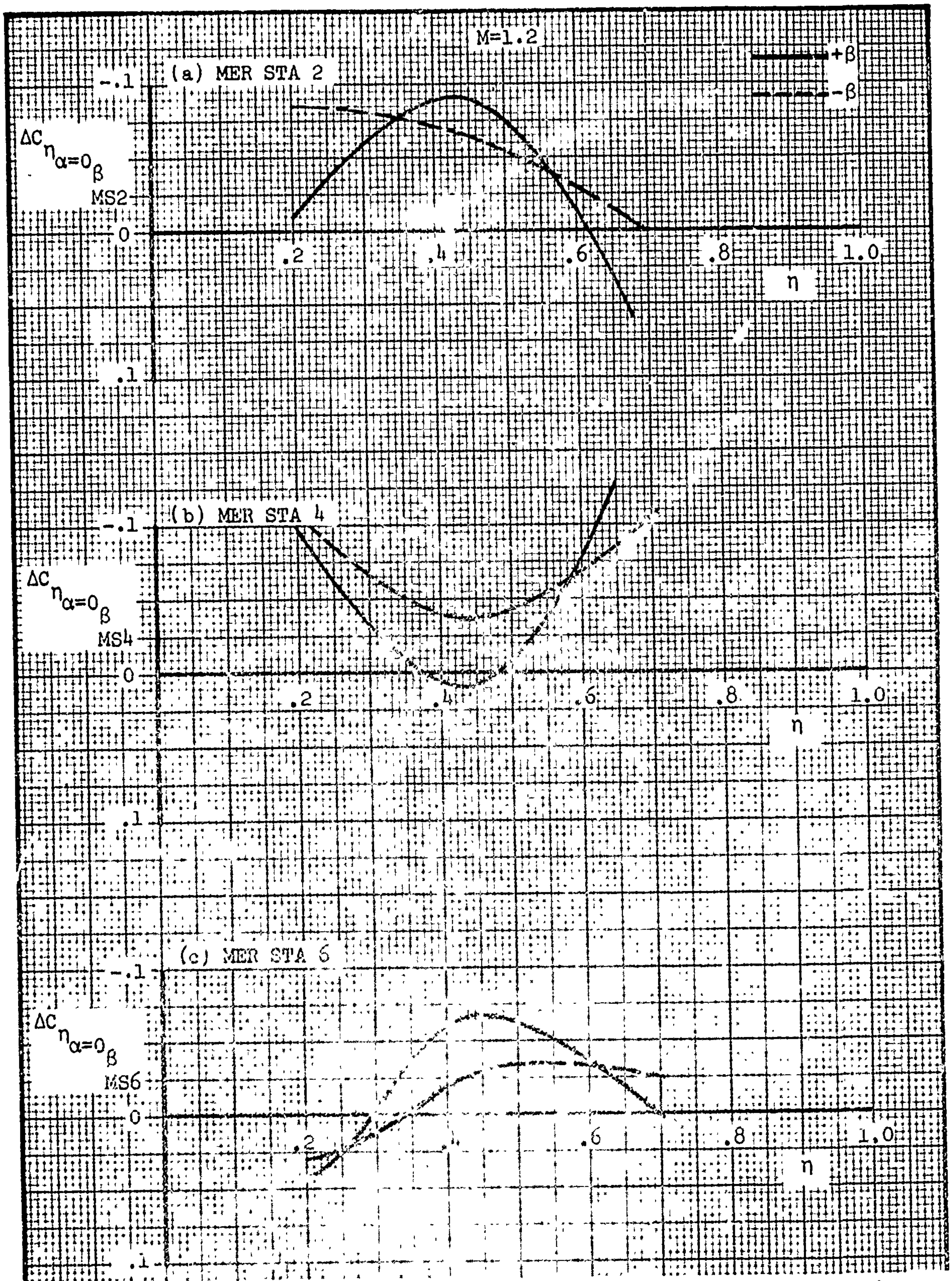



Figure 4[illegible]. Incremental Yawing Moment Intercept Due to Yaw - Spanwise Correction at M = 1.2 for MER Stations 2, 4 and 6

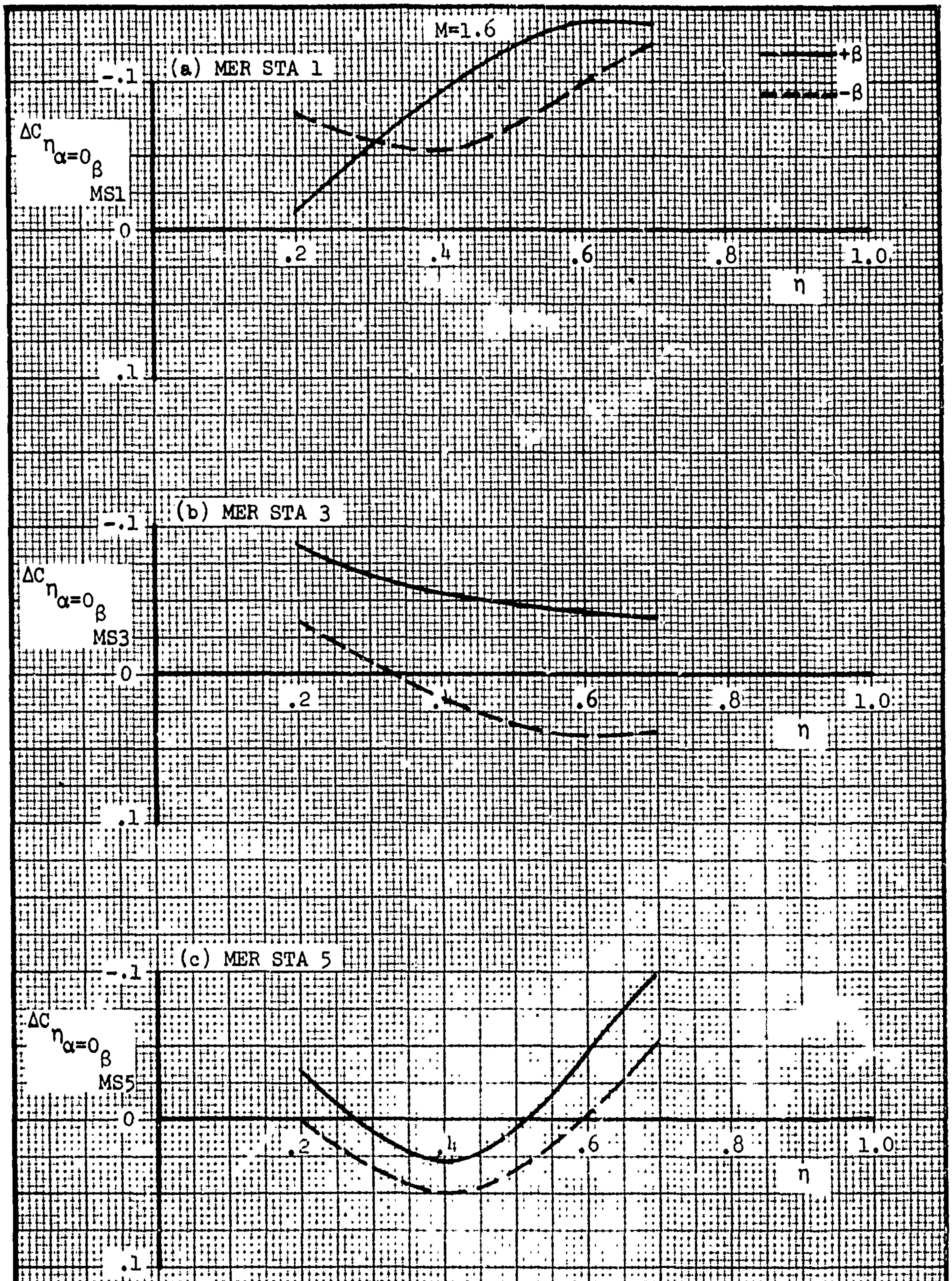



Figure 496. Incremental Yawing Moment Intercept Due to Yaw - Spanwise Correction at M = 1.6 for MER Stations 1, 3 and 5

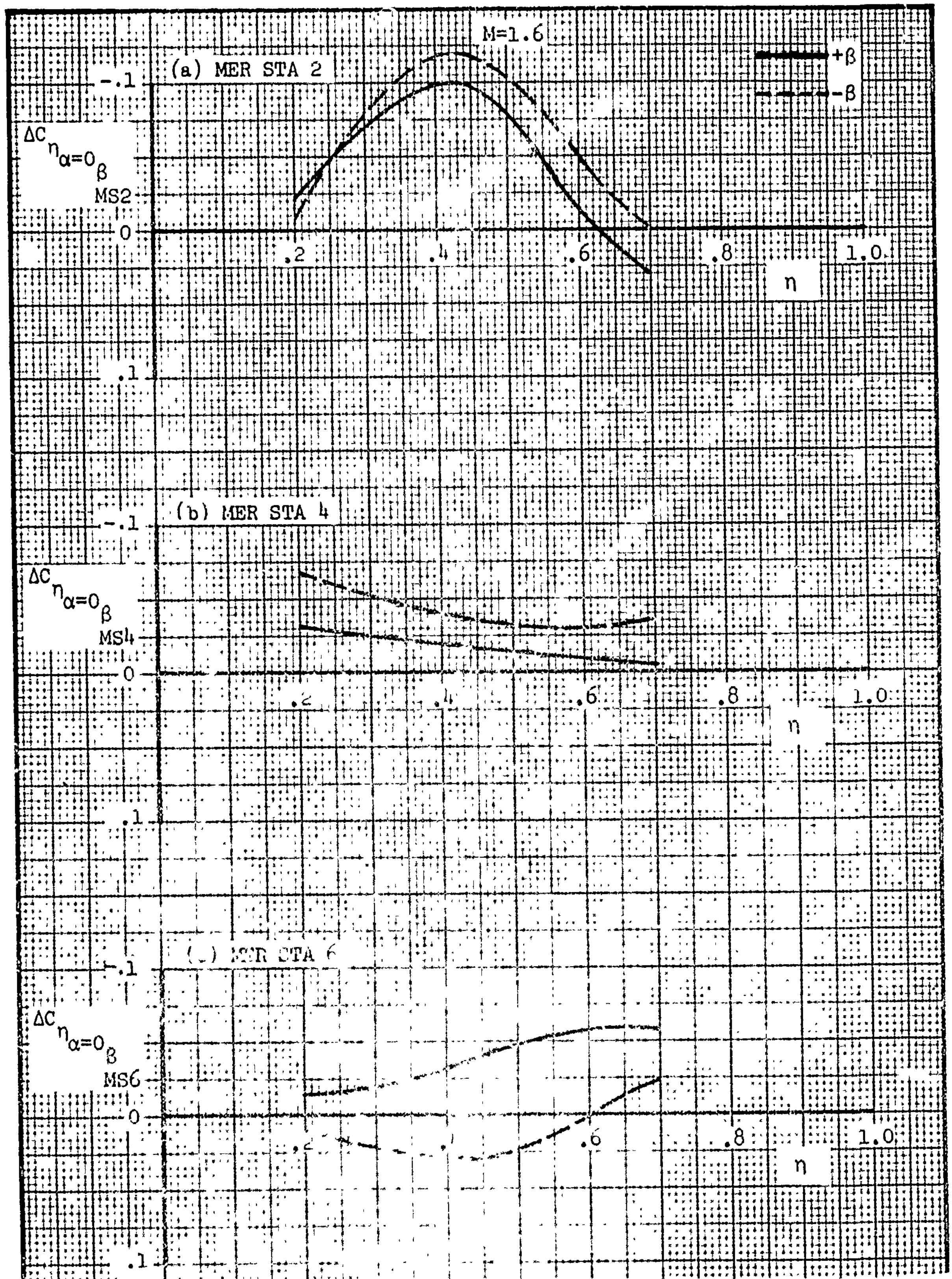



Figure 497. Incremental Yawing Moment Intercept Due to Yaw - Spanwise Correction at M = 1.6 for MER Stations 2, 4 and 6

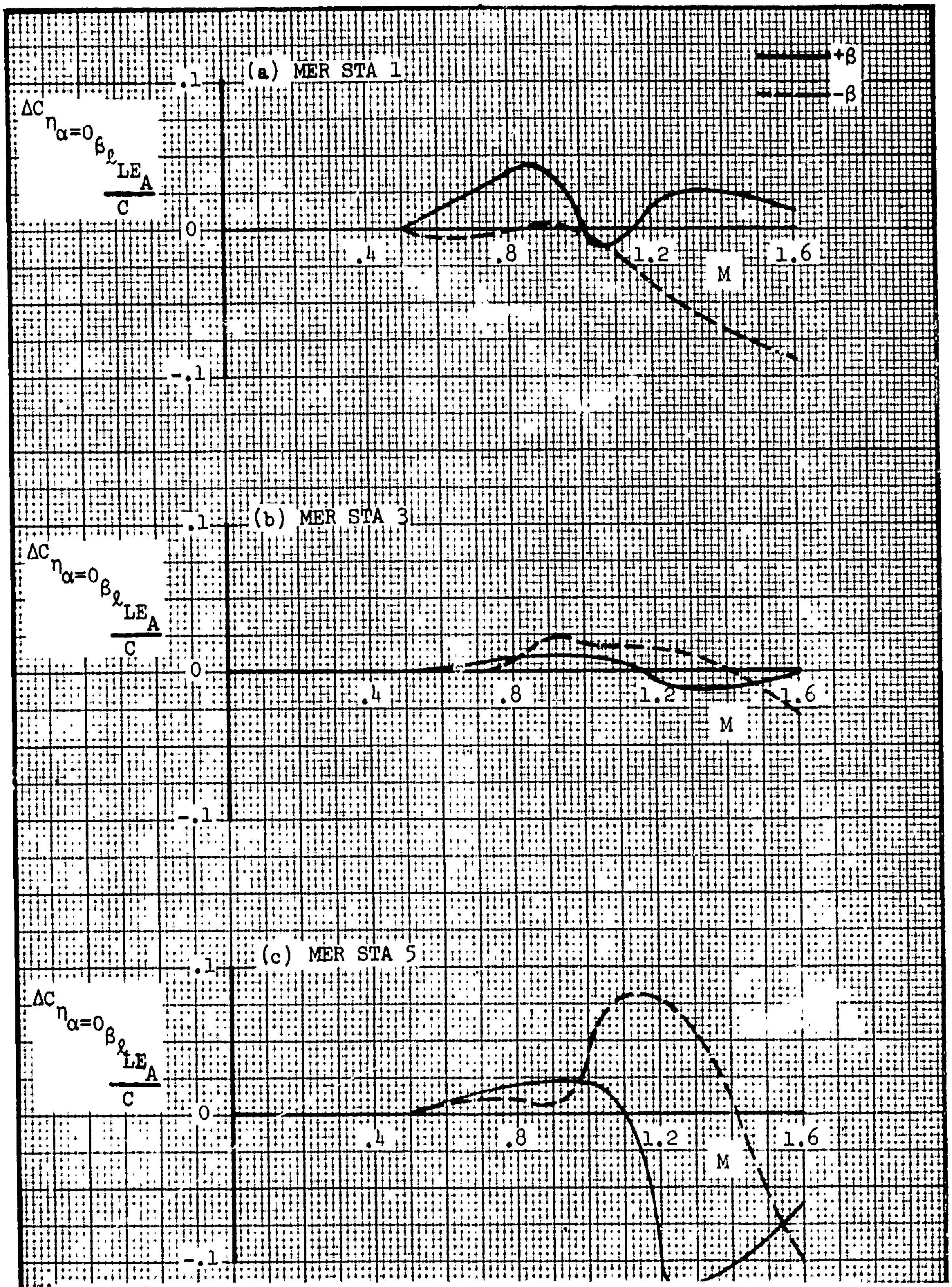



Figure 498. Incremental Yawing Moment Intercept Due to Yaw - Chordwise Correction for MER Stations 1, 3 and 5

4.2.3 Increment-Adjacent Store Interference

Methods to predict the increment in captive store yawing moment variation with angle of attack, $\Delta\left(\frac{YM}{q}\right)_{\alpha_{INTF}}$, and the value at $\alpha=0$, $\Delta\left(\frac{YM}{q}\right)_{\alpha=0_{INTF}}$, for multiple carried stores are presented within this section. The basic prediction is made as a function of minimum store to store separation distance, $y_{INTF}$ (see Subsection 3.1.3), at discrete Mach numbers. The data are presented separately for the aft cluster of stores on MER STATIONS 1, 3, and 5, and the forward cluster, MER STATIONS 2, 4, and 6. Predictions are also separately made for inboard→outboard interference, the interfering store carried inboard of the subject captive store, and outboard→inboard interference, the interfering store carried outboard of the subject captive store. On the curves defining the basic prediction, ADJ. SHOULDER refers to the MER shoulder store adjacent to the interfering store, OPPOSITE SHOULDER is the MER shoulder store furthest displaced laterally from the interfering store, and ℄ STORE is the MER centerline store, MER STATION 1 or 2.

4.2.3.1 Slope Prediction

The equations governing the prediction of incremental yawing moment variation with angle of attack are presented below:

INTERFERING STORES CARRIED INBOARD

MER STATIONS 1,2,3,4,5, and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{\substack{INTF\\MS1-6}}} = \left(\sum \Delta C_{n_{\alpha_{\substack{INTF\\IB\to OB\\MS1-6}}}}\right) K_{SCALE_{YM}}$$

where:

$\Delta C_{n_{\alpha}}{}_{\substack{INTF\\IB\to OB}}$ - Incremental yawing moment slope coefficient due to inboard to outboard interference as a function of $y_{INTF}$, $\frac{1}{deg}$, see Table 13.

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$ , see Section IV.

INTERFERING STORES CARRIED OUTBOARD

MER STATIONS 1, 2, 3, 4, 5, and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{\substack{INTF\\MS1-6}}} = \left(\sum \Delta C_{n_{\alpha}}{}_{\substack{INTF\\OB\to IB\\MS1-6}} + \sum \Delta^2 C_{n_{\alpha}}{}_{\substack{INTF\\MS1-6}}\right) K_{SCALE_{YM}}$$

where:

$\Delta C_{n_{\alpha}}{}_{\substack{INTF\\OB\to IB}}$ - Incremental yawing moment slope coefficient due to outboard to inboard interference as a function of $y_{INTF}$, $\frac{1}{deg}$, see Table 13.

$\Delta^2 C_{n_{\alpha}}{}_{INTF}$ - Increment to $\Delta C_{n_{\alpha}}{}_{\substack{INTF\\OB\to IB}}$ for the forward and aft cluster as a function of store nose separation, $\sqrt{x^2_{INTF} + y^2_{INTF}}$ (see Subsection 3.1.3), which is assumed to be negative when the interfering store is aft of the subject captive store, $\frac{1}{deg}$, Figures 514 and 515.

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

INTERFERING STORES CARRIED INBOARD AND OUTBOARD

MER STATIONS 1, 2, 3, 4, 5, and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{YM}{q}\right)_{\alpha_{\substack{INTF\\MS1-6}}} = \left[K_{INTC_1} + K_{SLOPE_1}\left(\sum \Delta C_{n_{\alpha_{\substack{INTF\\IB\to OB\\MS1-6}}}} + \sum \Delta C_{n_{\alpha_{\substack{INTF\\OB\to IB\\MS1-6}}}} + \sum \Delta^2 C_{n_{\alpha_{\substack{INTF\\MS1-6}}}}\right)\right] K_{SCALE_{YM}}$$

where:

$K_{INTC_1}$ - Intercept for the inboard - outboard combination correction for yawing moment slope, $\frac{1}{deg}$, Figure 517.

$K_{SLOPE_1}$ - Slope for the inboard - outboard combination correction for yawing moment slope, Figure 516.

$\Delta C_{n_{\alpha_{\substack{INTF\\IB\to OB}}}}$ - Previously defined.

$\Delta C_{n_{\alpha_{\substack{INTF\\OB\to IB}}}}$ - Previously defined.

$\Delta^2 C_{n_{\alpha_{INTF}}}$ - Previously defined.

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

The above equations define the interference increment calculation at a given Mach number. For Mach numbers other than those presented, M = 0.7, 0.9, 1.05, 1.2, 1.6, these guidelines should be followed. If the subject Mach number is less than M = 0.7 use the value at M = 0.7. For other Mach numbers linear interpolation should be used between the Mach numbers which are presented.

TABLE 13. INCREMENTAL YAWING MOMENT SLOPE COEFFICIENT DUE TO INTERFERENCE - FIGURE LOCATION GUIDE

| $\Delta C_{n_{\alpha}}$ INTF | MACH NUMBER 0.7 | 0.9 | 1.05 | 1.2 | 1.6 |
|---|---|---|---|---|---|
| | Figure Number | | | | |
| Adj. Shoulder-Fwd. Cluster | 499 | 500 | 501 | 502 | 503 |
| Adj. Shoulder-Aft Cluster | 499 | 500 | 501 | 502 | 503 |
| ℄ Store-Fwd. Cluster | 504 | 505 | 506 | 507 | 508 |
| ℄ Store-Aft Cluster | 504 | 505 | 506 | 507 | 508 |
| Opposite Shoulder-Fwd. Cluster | 509 | 510 | 511 | 512 | 513 |
| Opposite Shoulder-Aft Cluster | 509 | 510 | 511 | 512 | 513 |

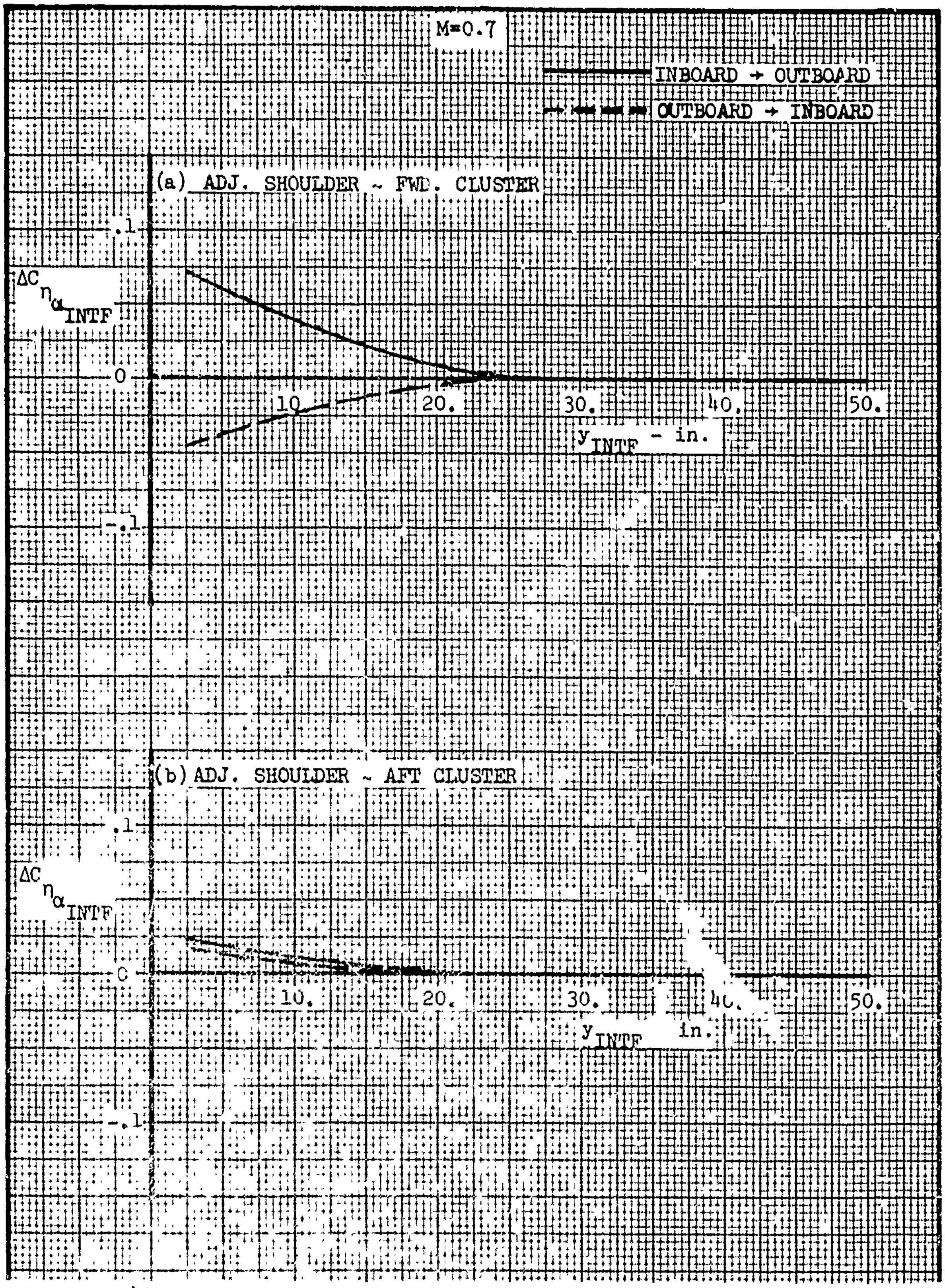



Figure 499. Incremental Yawing Moment Intercept Due to Interference - Adjacent Shoulder at M = 0.7

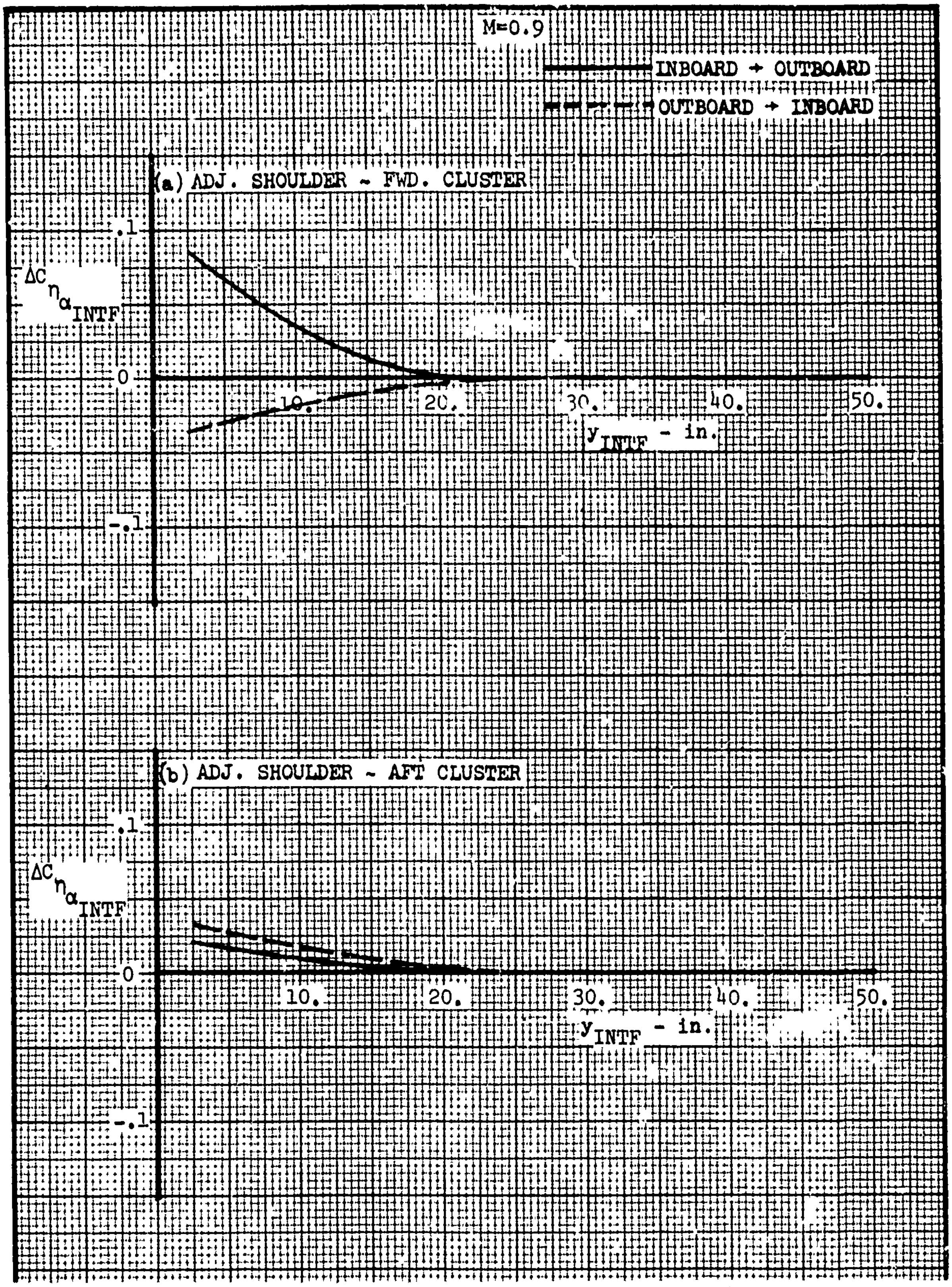



Figure 500. Incremental Yawing Moment Slope Due to Interference - Adjacent Shoulder at M = 0.9

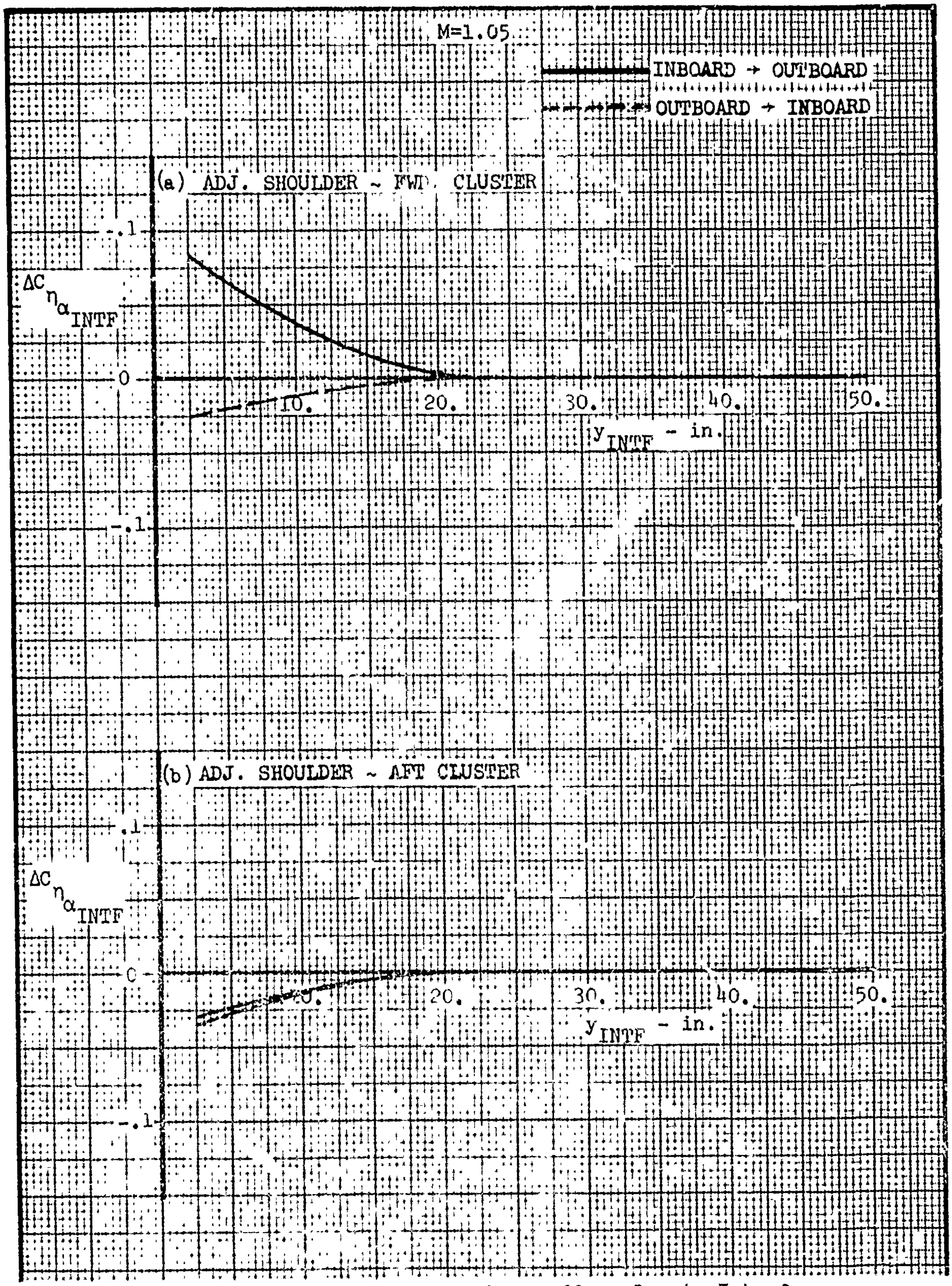



Figure 501. Incremental Yawing Moment Slope Due to Interference - Adjacent Shoulder at M = 1.05

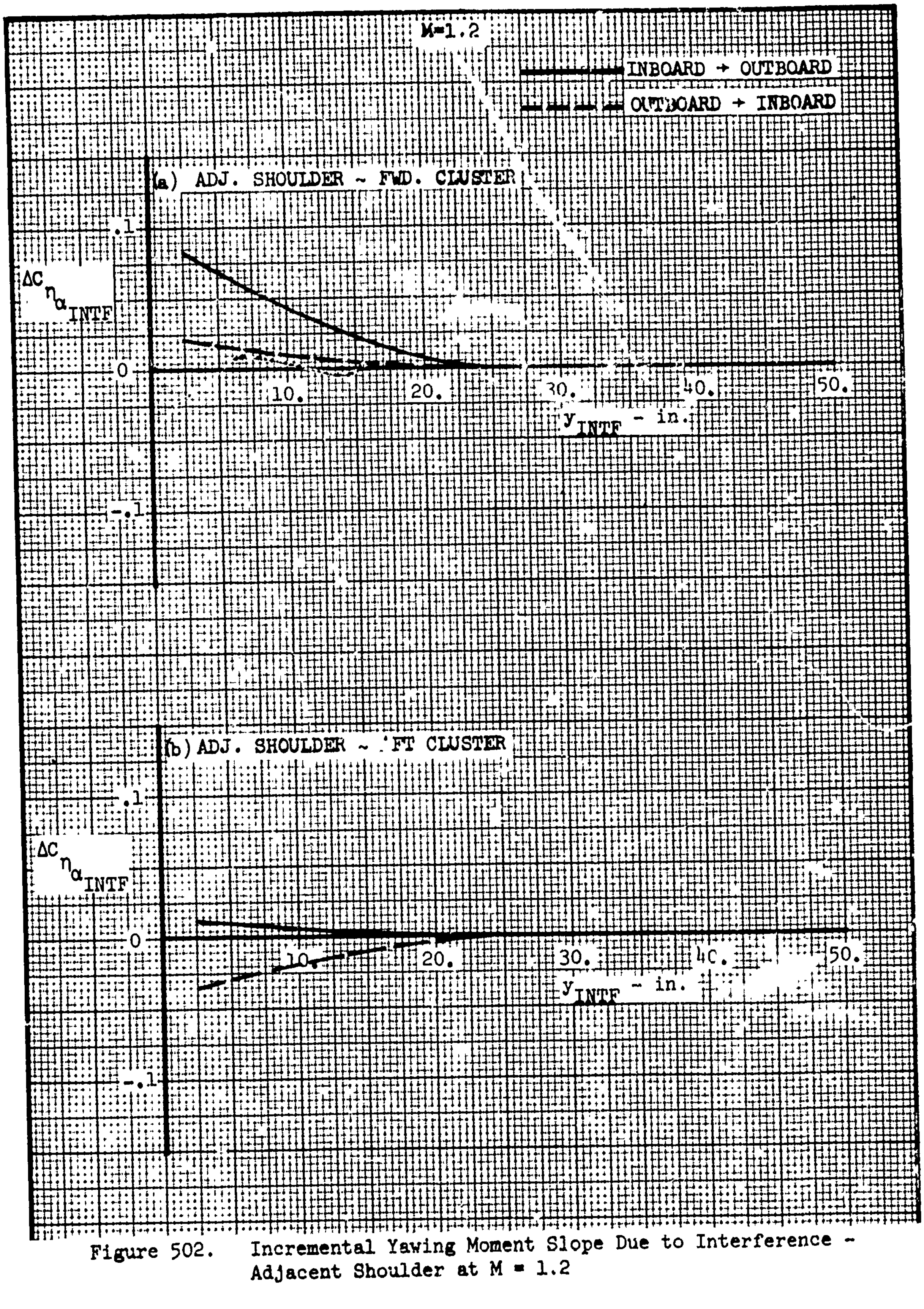



Figure 502. Incremental Yawing Moment Slope Due to Interference - Adjacent Shoulder at M = 1.2

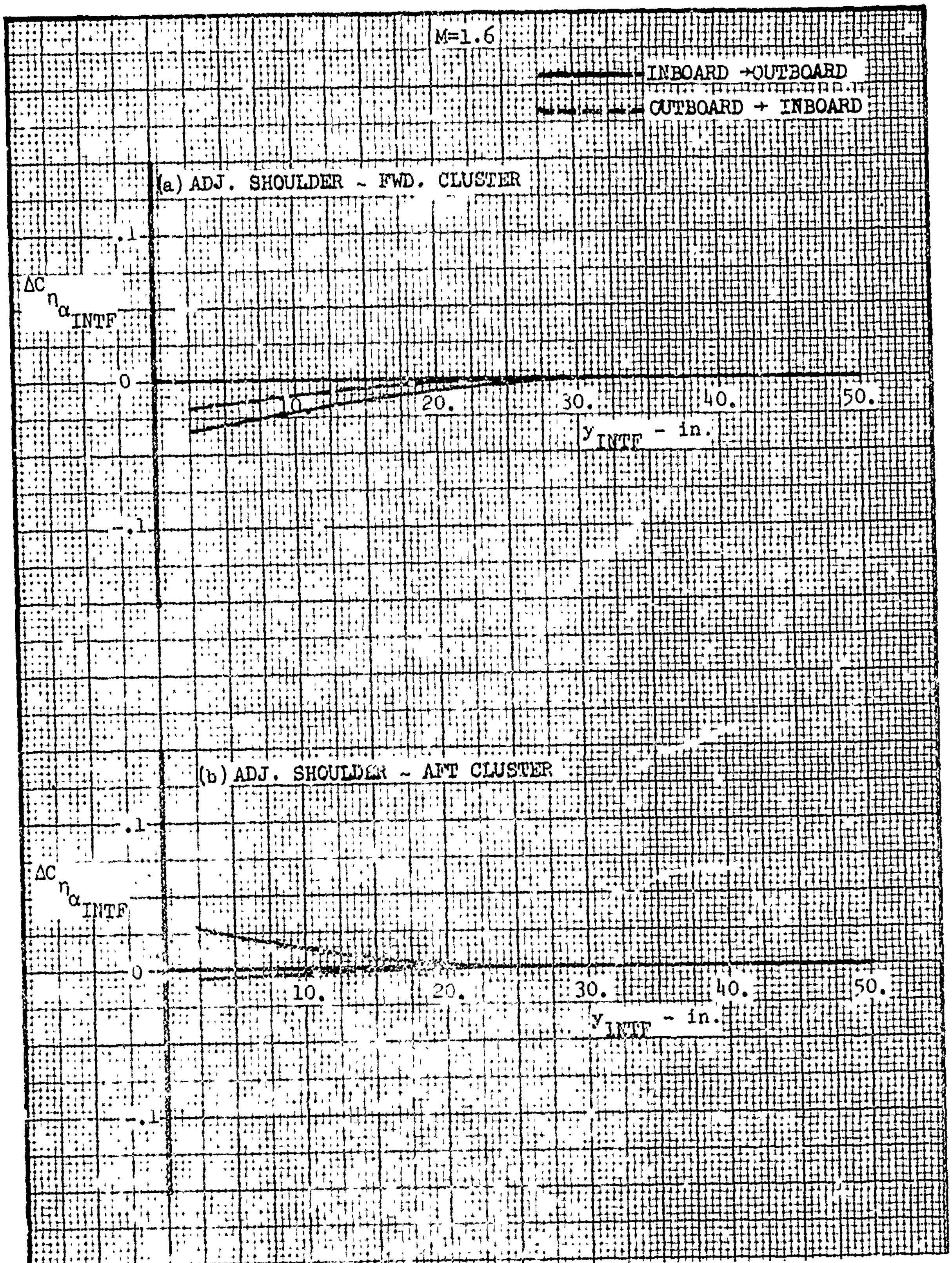



Figure 503. Incremental Yawing Moment Slope Due to Interference - Adjacent Shoulder at M = 1.6

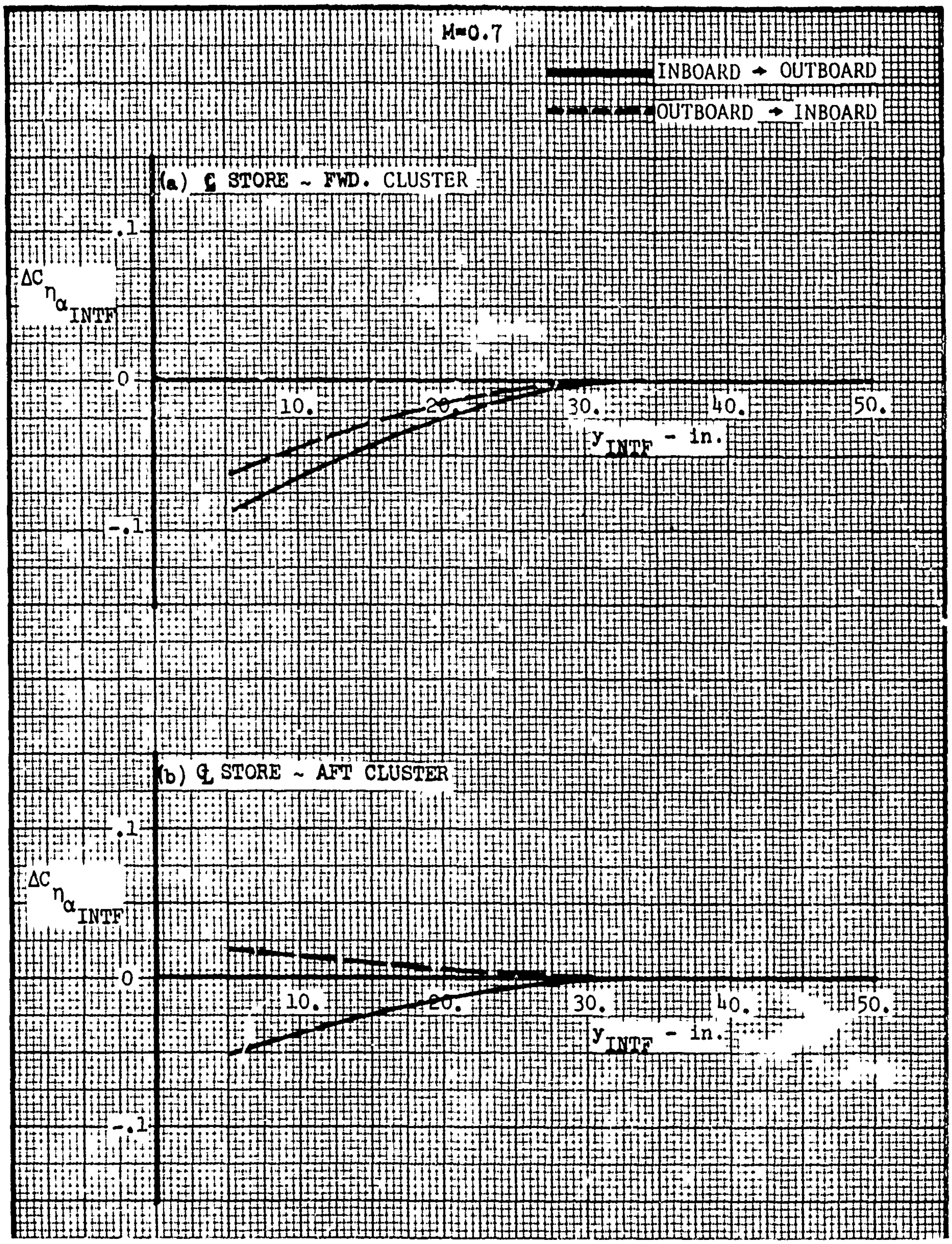



Figure 504. Incremental Yawing Moment Slope Due to Interference - Centerline Store at M = 0.7

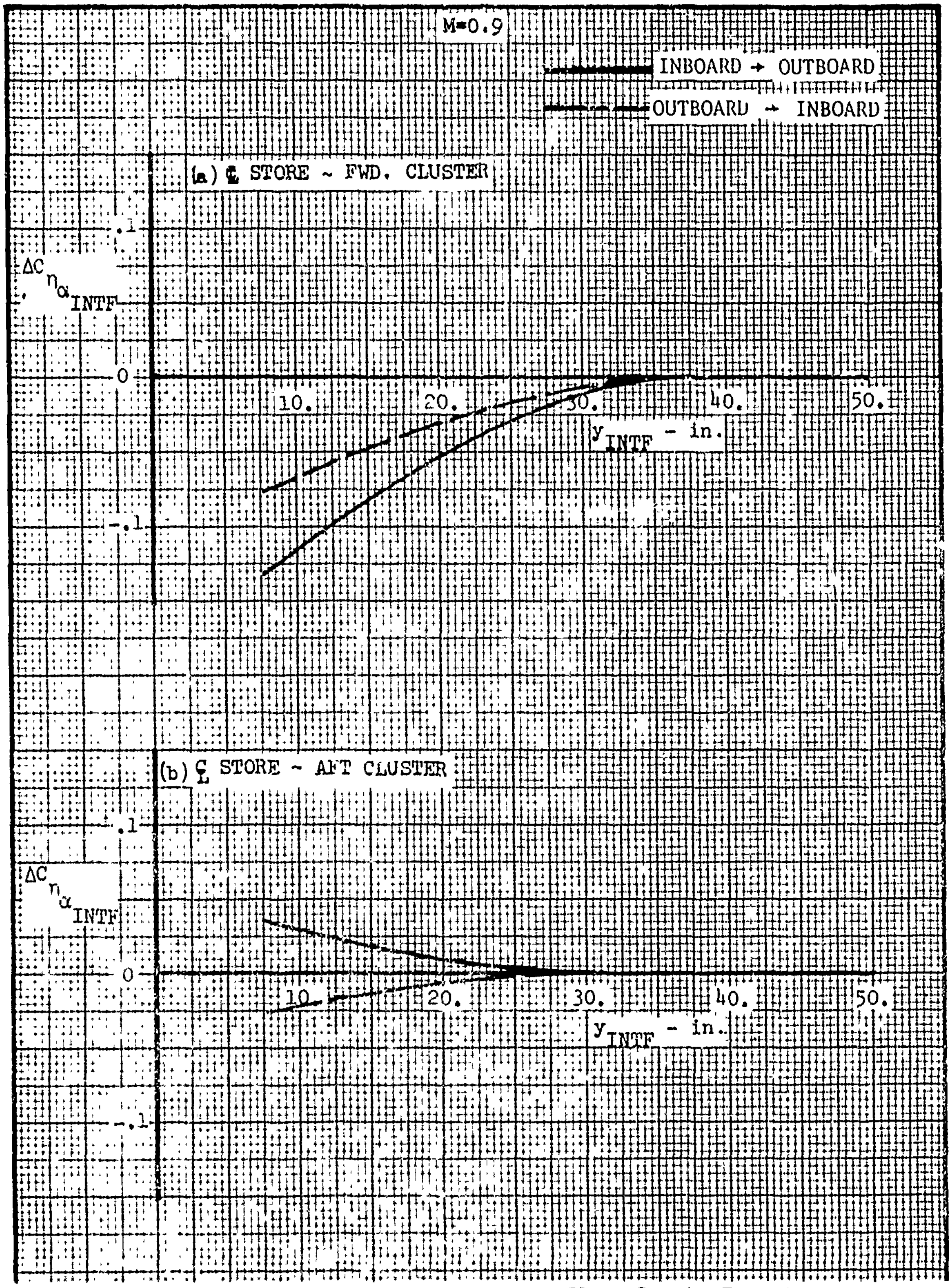



Figure 505. Incremental Yawing Moment Slope Due to Interference - Centerline Store at M = 0.9

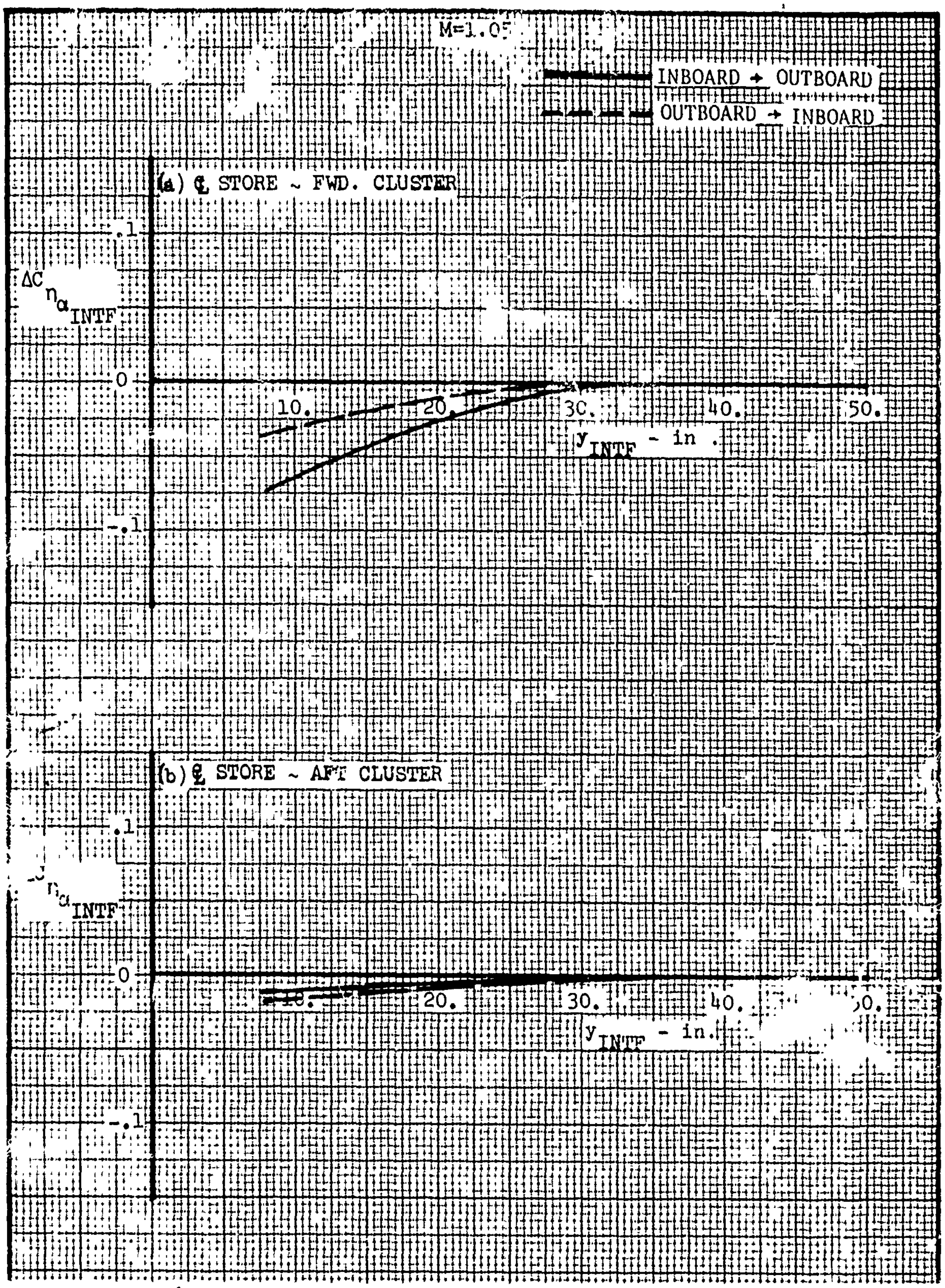



Figure 506. Incremental Yawing Moment Slope Due to Interference - Centerline Store at M = 1.05

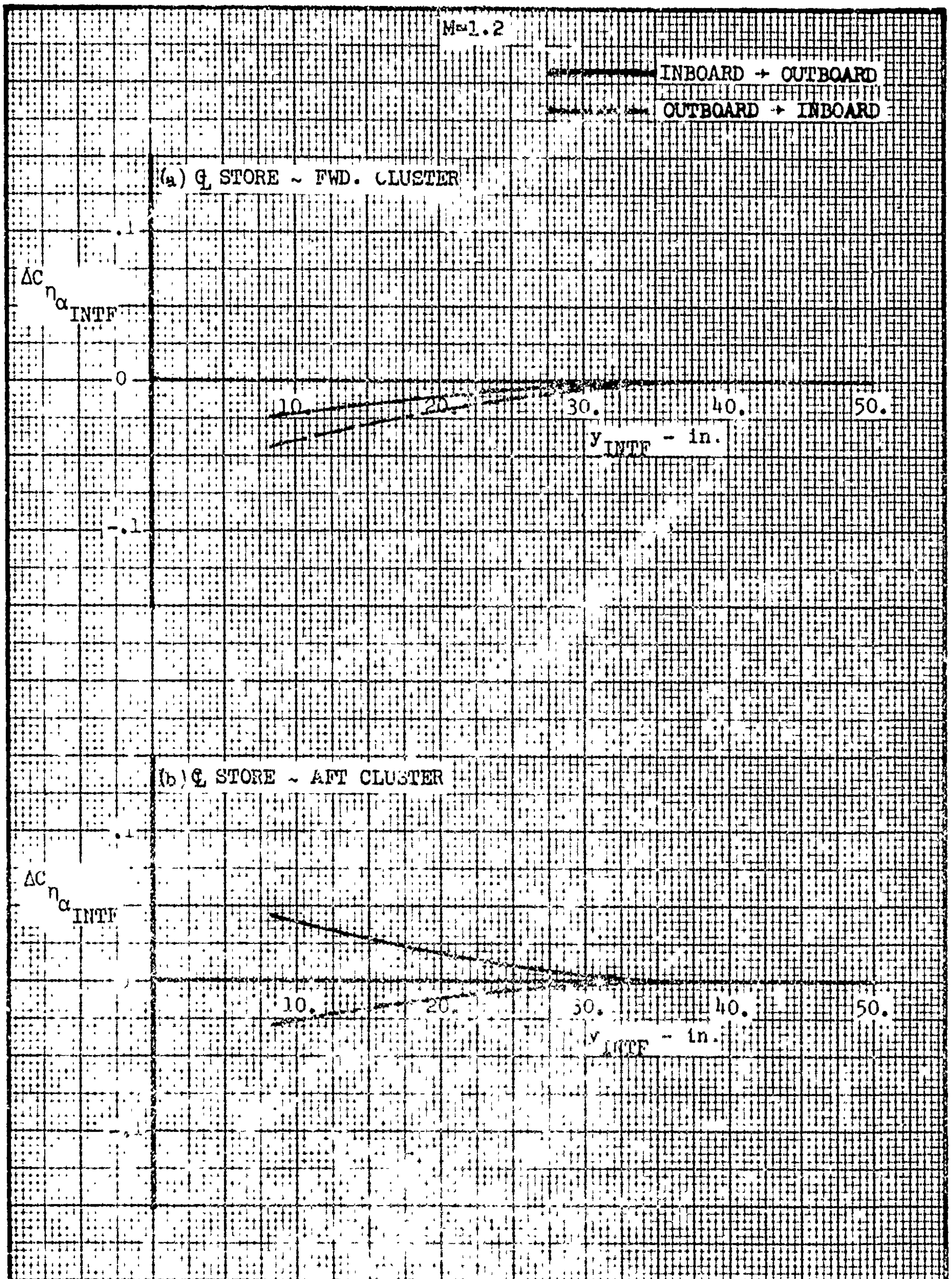



Figure 5?7. Incremental Yawing Moment Slope Due to Interference - Centerline Store at M = 1.2

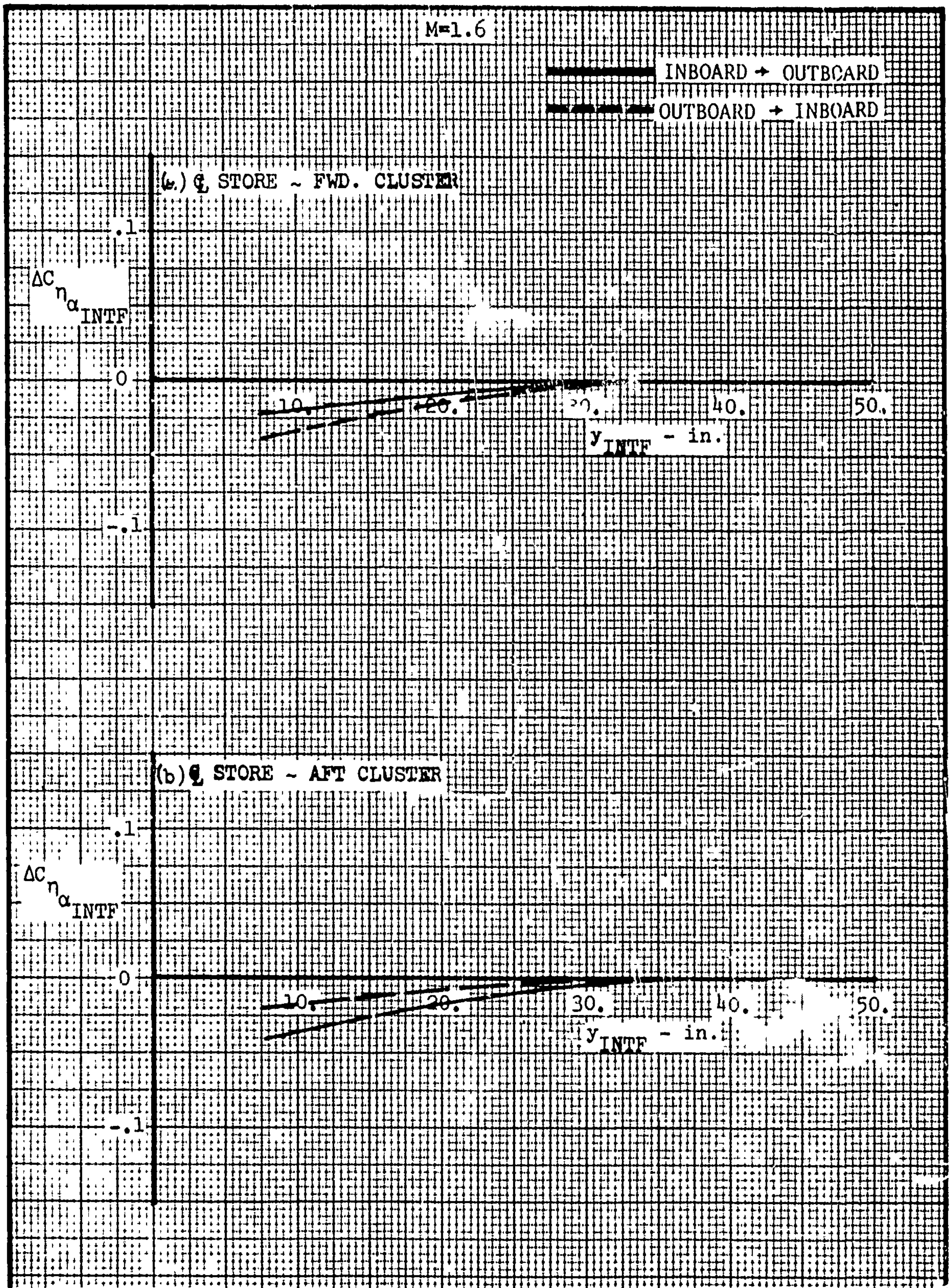



Figure 508. Incremental Yawing Moment Slope Due to Interference - Centerline Store at M = 1.6

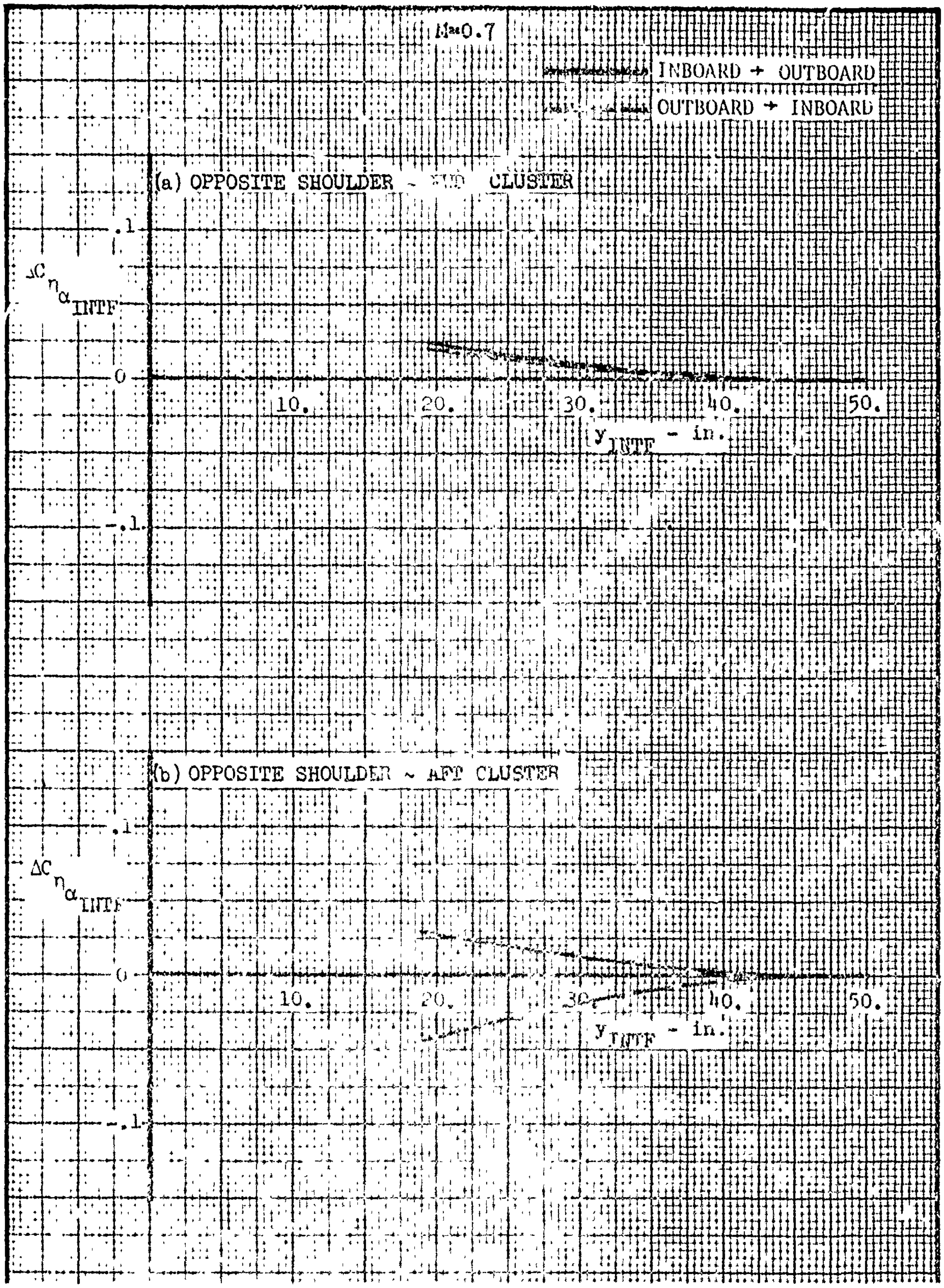



Figure 509. Incremental Yawing Moment Slope Due to Interference - Opposite Shoulder at M = 0.7

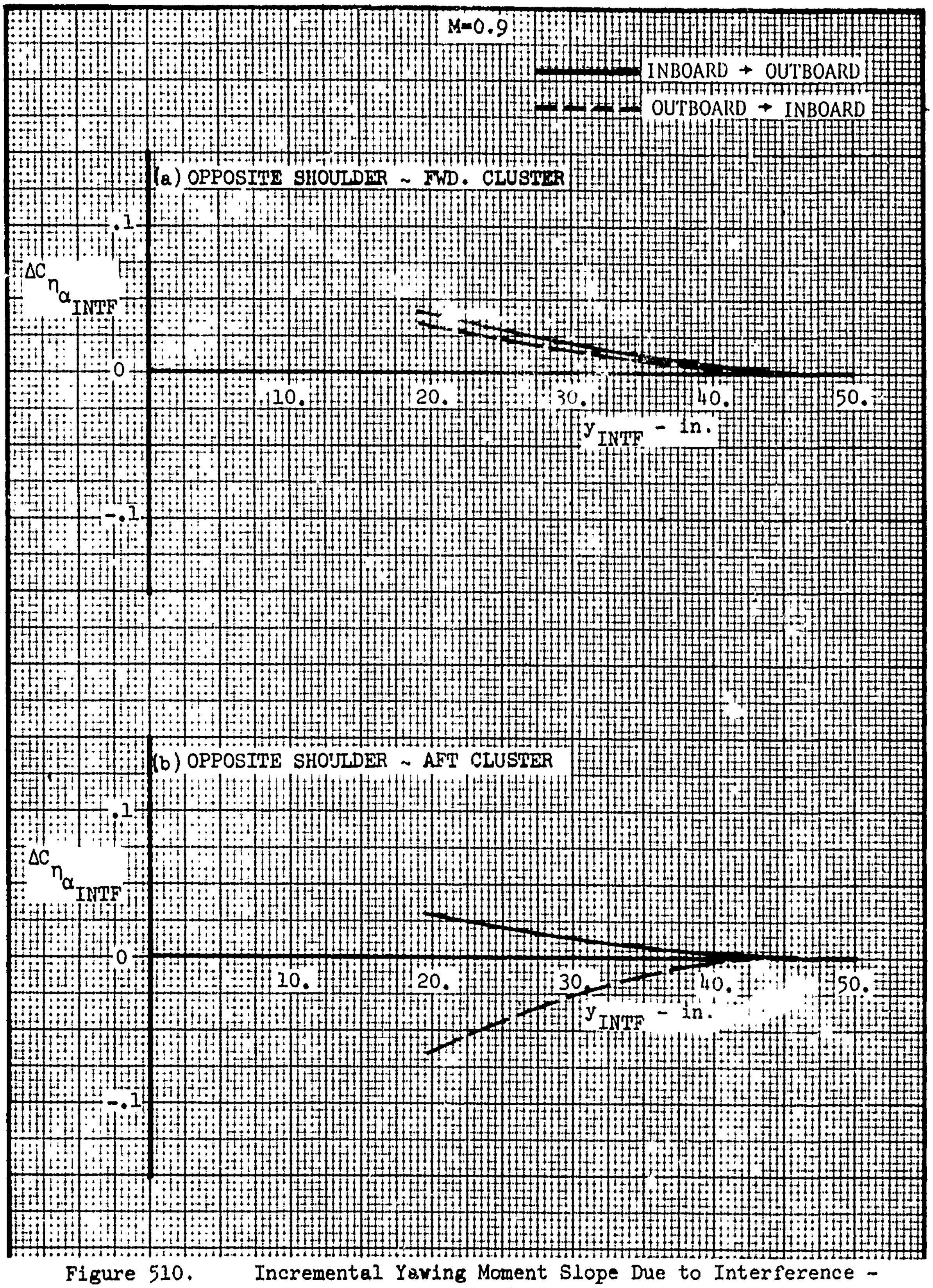



Figure 510. Incremental Yawing Moment Slope Due to Interference - Opposite Shoulder at M = 0.9

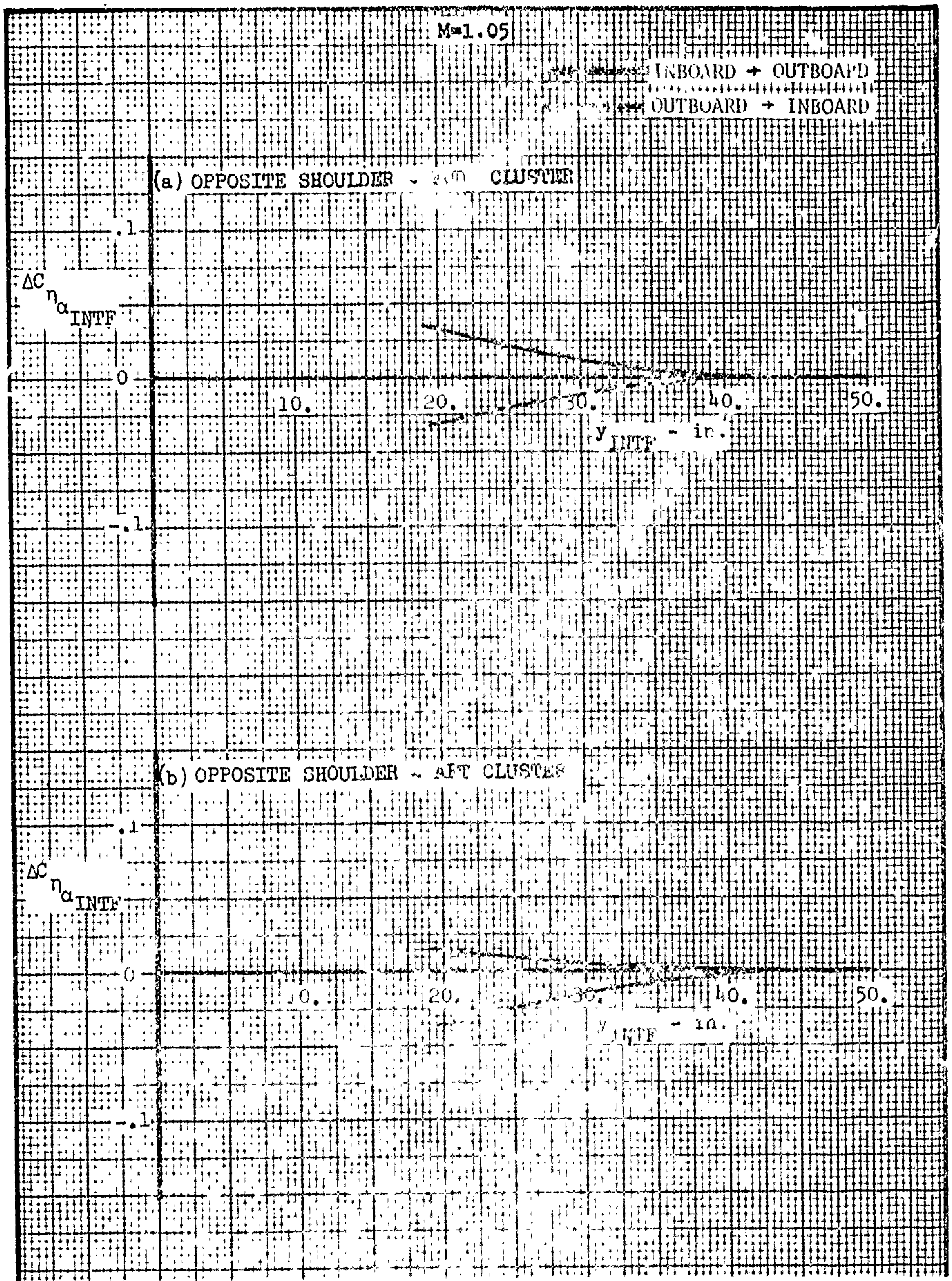



Figure 511. Incremental Yawing Moment Slope Due to Interference - Opposite Shoulder at M = 1.05

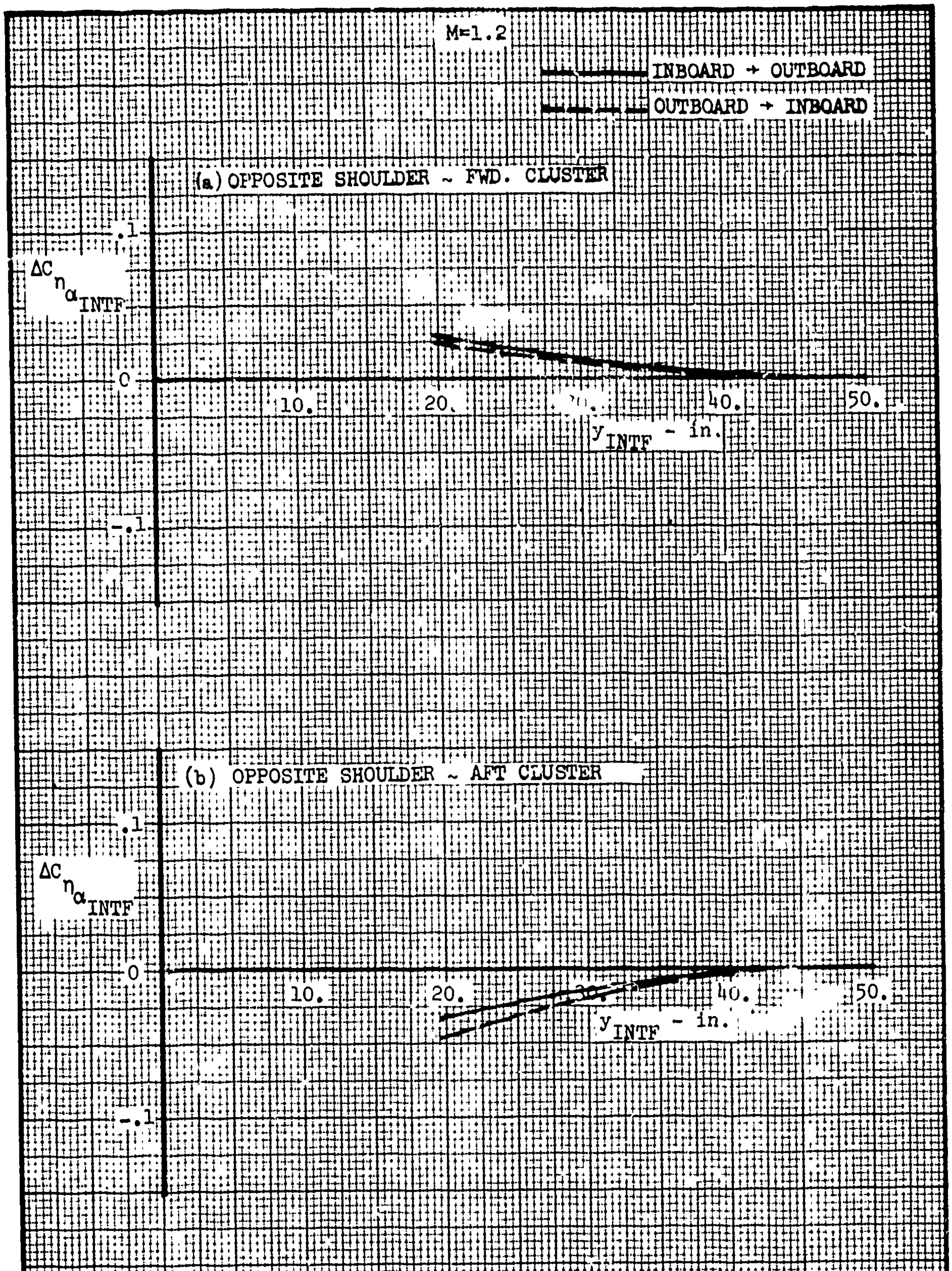



Figure 512. Incremental Yawing Moment Slope Due to Interference - Opposite Shoulder at M = 1.2

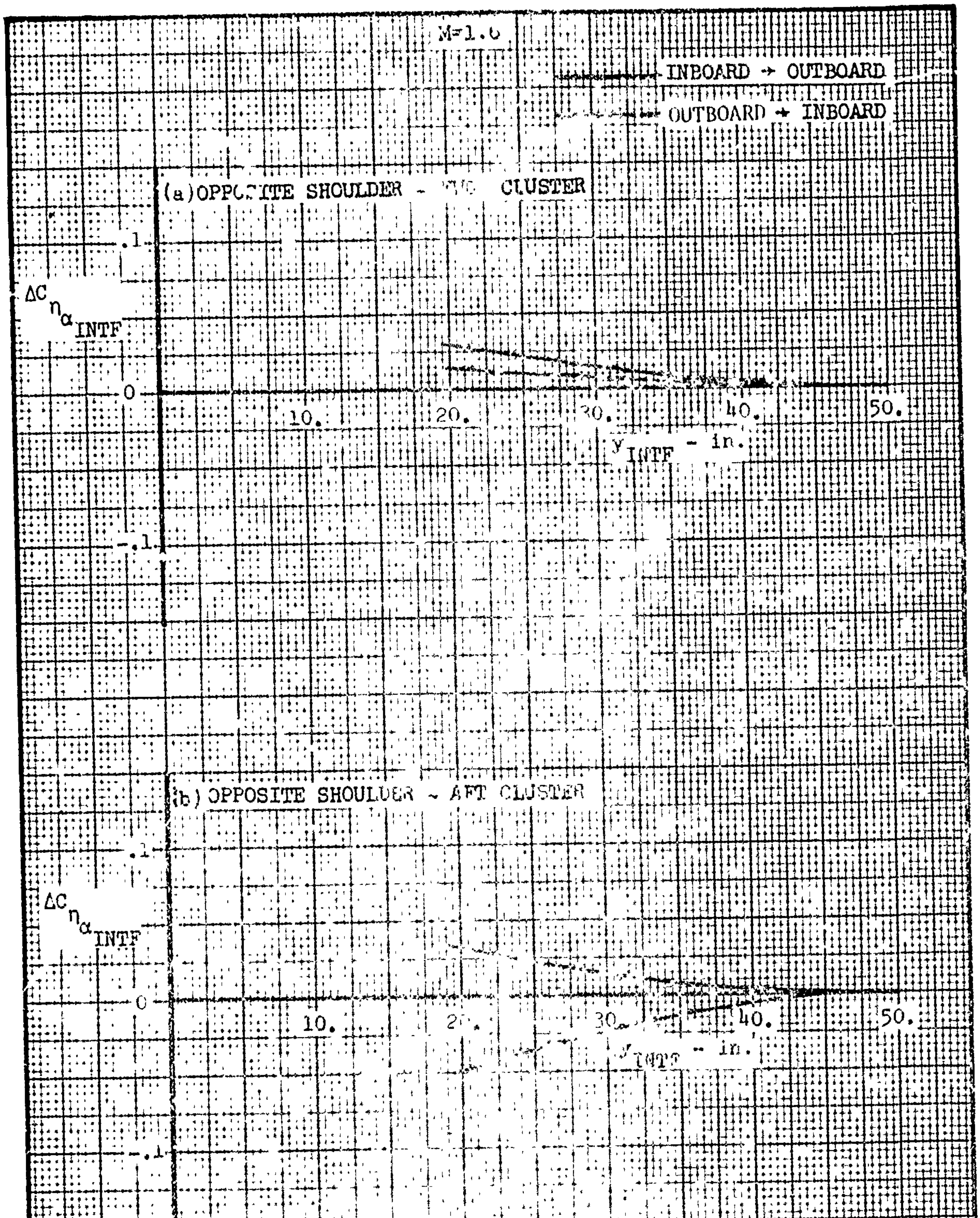



Figure 513. Incremental Yawing Moment Slope Due to Interference - Opposite Shoulder At M = 1.6

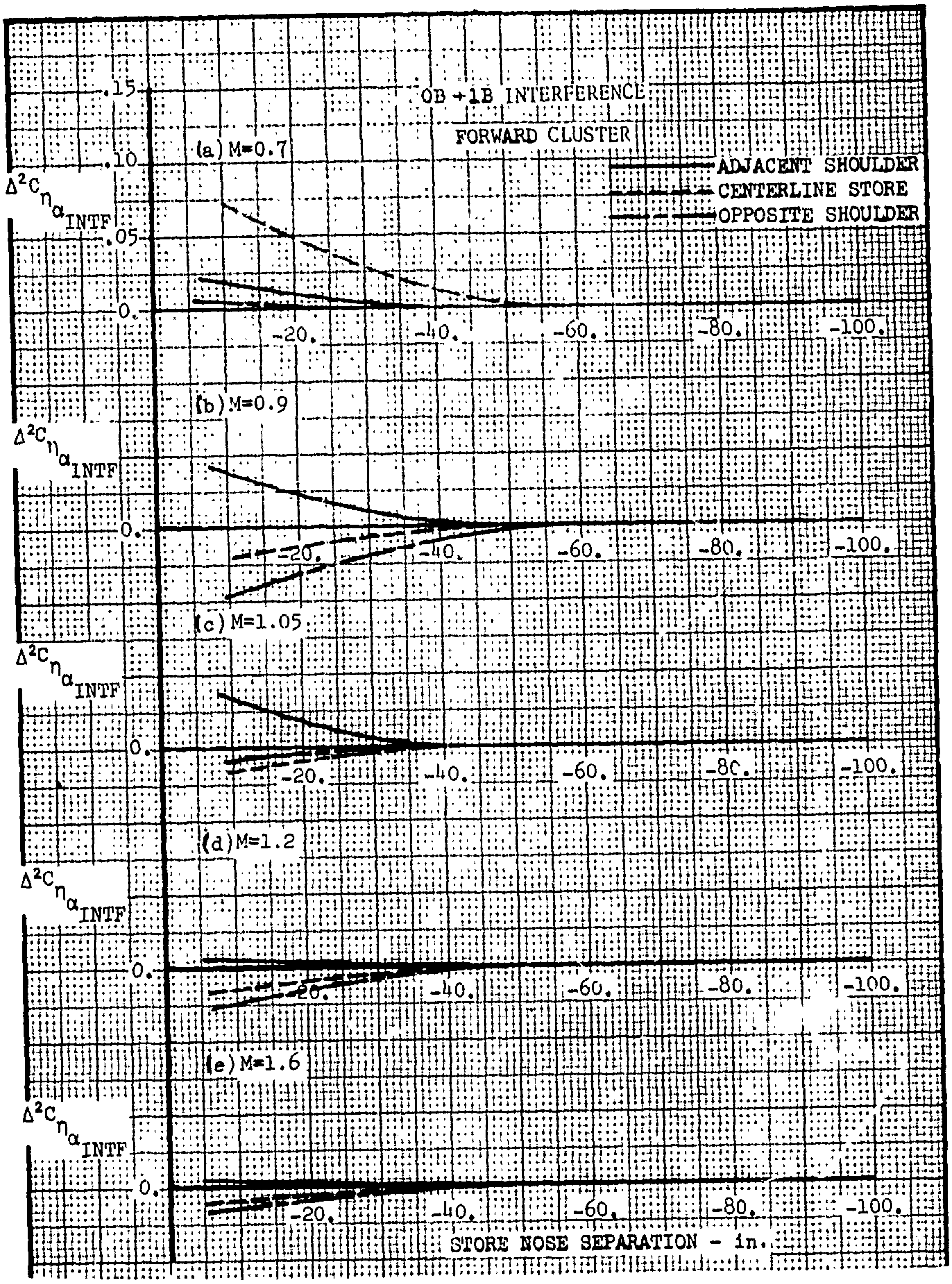



Figure 514. Incremental Yawing Moment Slope Due to Interference - Outboard to Inboard Interference Correction for the Forward Cluster

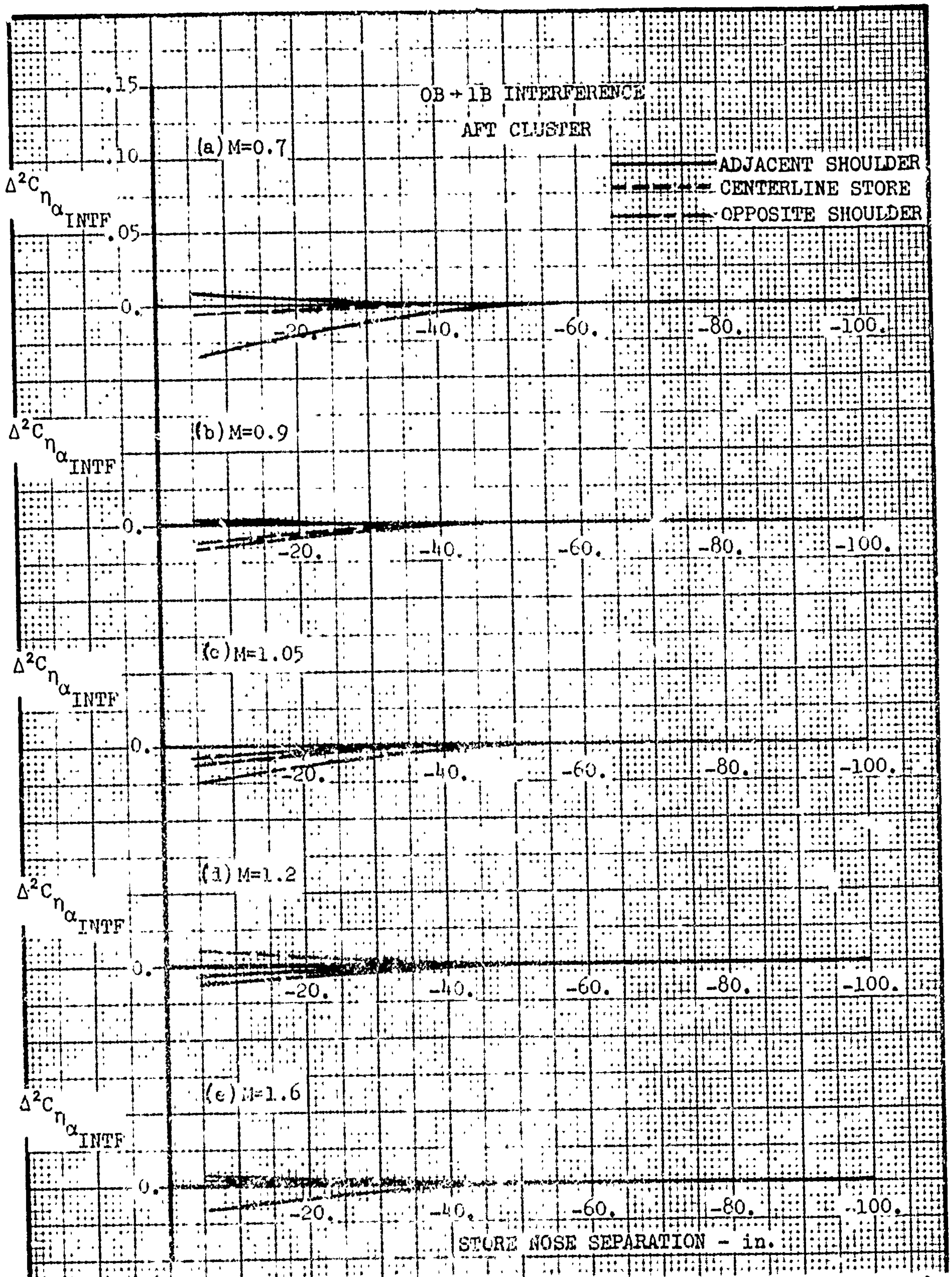



Figure 515. Incremental Yawing Moment Slope Due to Interference - Outboard to Inboard Interference Correction for the Aft Cluster

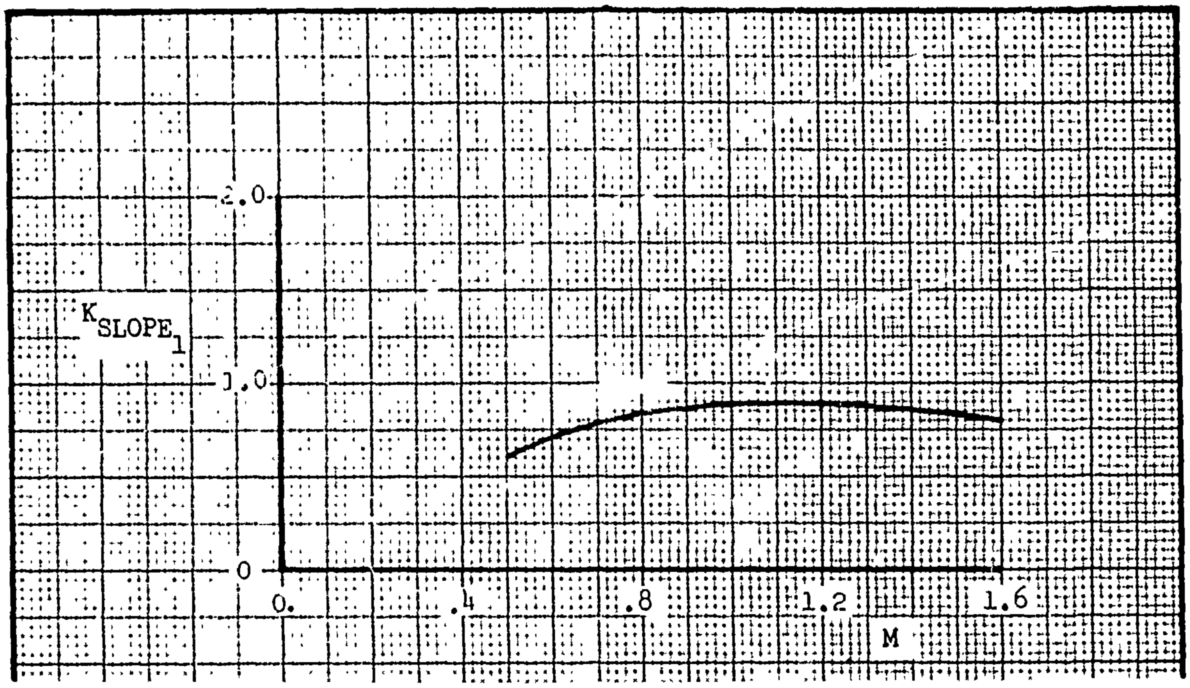



Figure 516. Incremental Yawing Moment Slope Due to Interference - $K_{SLOPE_1}$ for Combination Inboard and Outboard Interference

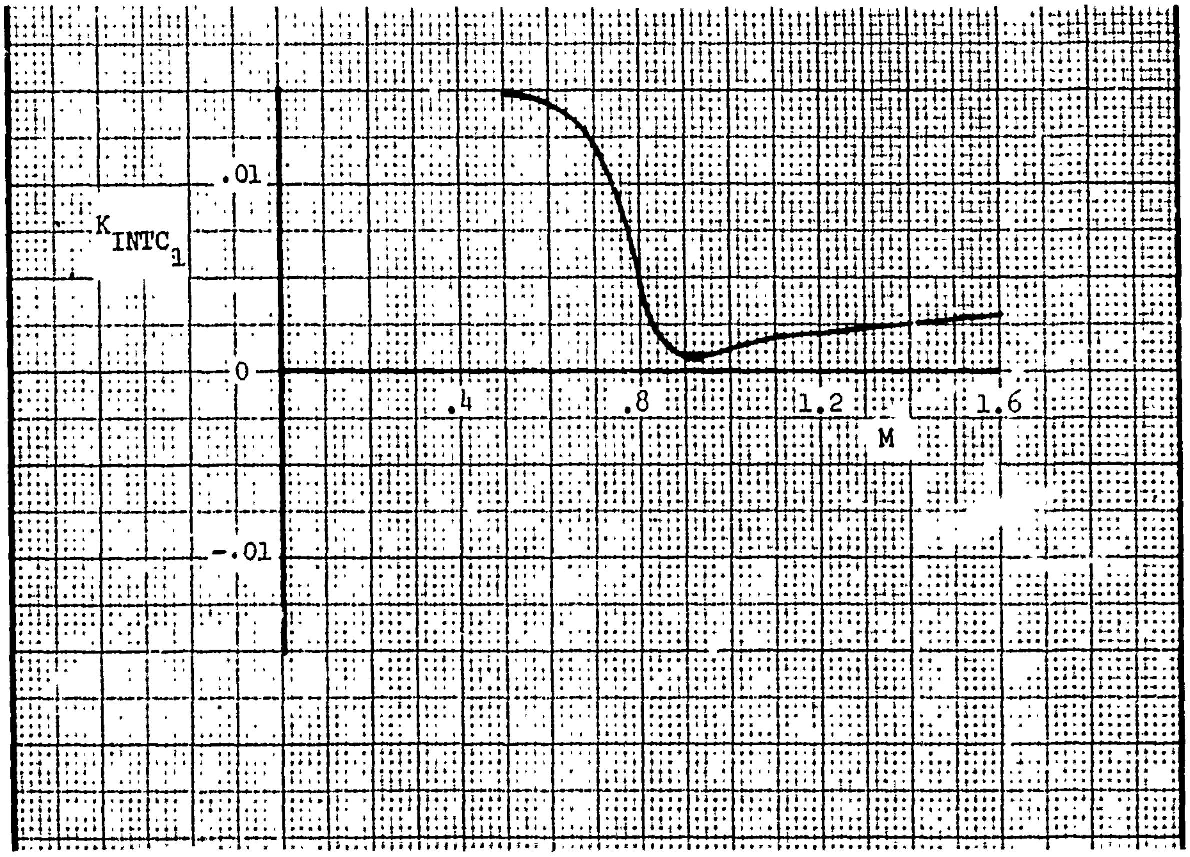



Figure 517. Incremental Yawing Moment Slope Due to Interference - $K_{INTC_1}$ for Combination Inboard and Outboard Interference

4.2.3.2 Intercept Prediction

The equations governing the prediction of incremental yawing moment intercept are presented below.

INTERFERING STORES CARRIED INBOARD

MER STATIONS 1, 2, 3, 4, 5, and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{YM}{q}\right)_{\substack{=0\\ INTF\\ MS1-6}} = \left(\sum \Delta C_{n_{\substack{\alpha\\ INTF\\ IB\rightarrow OB\\ MS1-6}}}\right) K_{SCALE_{YM}}$$

where:

$\Delta C_{n_{\substack{\alpha=0\\ INTF\\ IB\rightarrow OB}}}$ - Incremental yawing moment intercept coefficient due to inboard to outboard interference as a function of $y_{INTF}$, see Table 14.

$K_{SCALE_{YM}}$ - Yawing moment scale factor, ft$^3$, see Section IV.

INTERFERING STORES CARRIED OUTBOARD

MER STATIONS 1, 2, 3, 4, 5, and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{YM}{q}\right)_{\substack{\alpha=0\\ INTF\\ MS1-6}} = \left(\sum \Delta C_{n_{\substack{\alpha=0\\ INTF\\ OB\rightarrow IB\\ MS1-6}}} + \sum \Delta^2 C_{n_{\substack{\alpha=0\\ INTF\\ MS1-6}}}\right) K_{SCALE_{YM}}$$

where:

$\Delta C_{n_{\alpha=0}\atop{INTF \atop OB \to IB}}$ - Incremental yawing moment intercept coefficient due to outboard to inboard interference as a function of $y_{INTF}$, see Table 14.

$\Delta^2 C_{n_{\alpha=0}\atop INTF}$ - Increment to $\Delta C_{n_{\alpha=0}\atop{INTF \atop OB \to IB}}$ for the forward and aft cluster as a function of store nose separation, $\sqrt{x^2_{INTF} + y^2_{INTF}}$ (see Subsection 3.1.3) which is assumed to be negative when the interfering store is aft of the subject captive store, Figures 533 and 534.

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

INTERFERING STORES CARRIED INBOARD AND OUTBOARD

MER STATIONS 1,2,3,4,5,and 6 (MS1-6):

AT A GIVEN MACH NUMBER:

$$\Delta\left(\frac{YM}{q}\right)_{\alpha=0 \atop {INTF \atop MS1-6}} = \left[K_{INTC_2} + K_{SLOPE_2}\left(\sum \Delta C_{n_{\alpha=0}\atop{INTF \atop {IB \to OB \atop MS1-6}}} + \sum \Delta C_{n_{\alpha=0}\atop{INTF \atop {OB \to IB \atop MS1-6}}} + \sum \Delta^2 C_{n_{\alpha=0}\atop{INTF \atop MS1-6}}\right)\right] K_{SCALE_{YM}}$$

where:

$K_{INTC_2}$ - Intercept for the inboard-outboard combination correction for yawing moment intercept, Figure 536.

$K_{SLOPE_2}$ - Slope for the inboard-outboard combination correction for yawing moment intercept, Figure 535.

$\Delta C_{n_{\alpha=0} \text{ INTF. IB}\to\text{OB}}$ - Previously defined.

$\Delta C_{n_{\alpha=0} \text{ INTF OB}\to\text{IB}}$ - Previously defined.

$\Delta^2 C_{n_{\alpha=0} \text{ INTF}}$ - Previously defined.

$K_{SCALE_{YM}}$ - Yawing moment scale factor, $ft^3$, see Section IV.

The above equations define the interference increment calculation at a given Mach number. For Mach numbers other than those presented, M = 0.7, 0.9, 1.05, 1.2, 1.6, these guidelines should be followed. If the subject Mach number is less than M = 0.7, use the value at M = 0.7. For other Mach numbers linear interpolation should be used between the Mach numbers which are presented.

TABLE 14. INCREMENTAL YAWING MOMENT INTERCEPT COEFFICIENT DUE TO INTERFERENCE - FIGURE LOCATION GUIDE

| $\Delta C_{n_{\alpha=0}}$ INTF | MACH NUMBER | | | | |
|---|---|---|---|---|---|
| | 0.7 | 0.9 | 1.05 | 1.2 | 1.6 |
| | Figure Numbers | | | | |
| Adj. Shoulder-Fwd. Cluster | 518 | 519 | 520 | 521 | 522 |
| Adj. Shoulder-Aft Cluster | 518 | 519 | 520 | 521 | 522 |
| ℄ Store-Fwd. Cluster | 523 | 524 | 525 | 526 | 527 |
| ℄ Store-Aft Cluster | 523 | 524 | 525 | 526 | 527 |
| Opposite Shoulder-Fwd. Cluster | 528 | 529 | 530 | 531 | 532 |
| Opposite Shoulder-Aft Cluster | 528 | 529 | 530 | 531 | 532 |

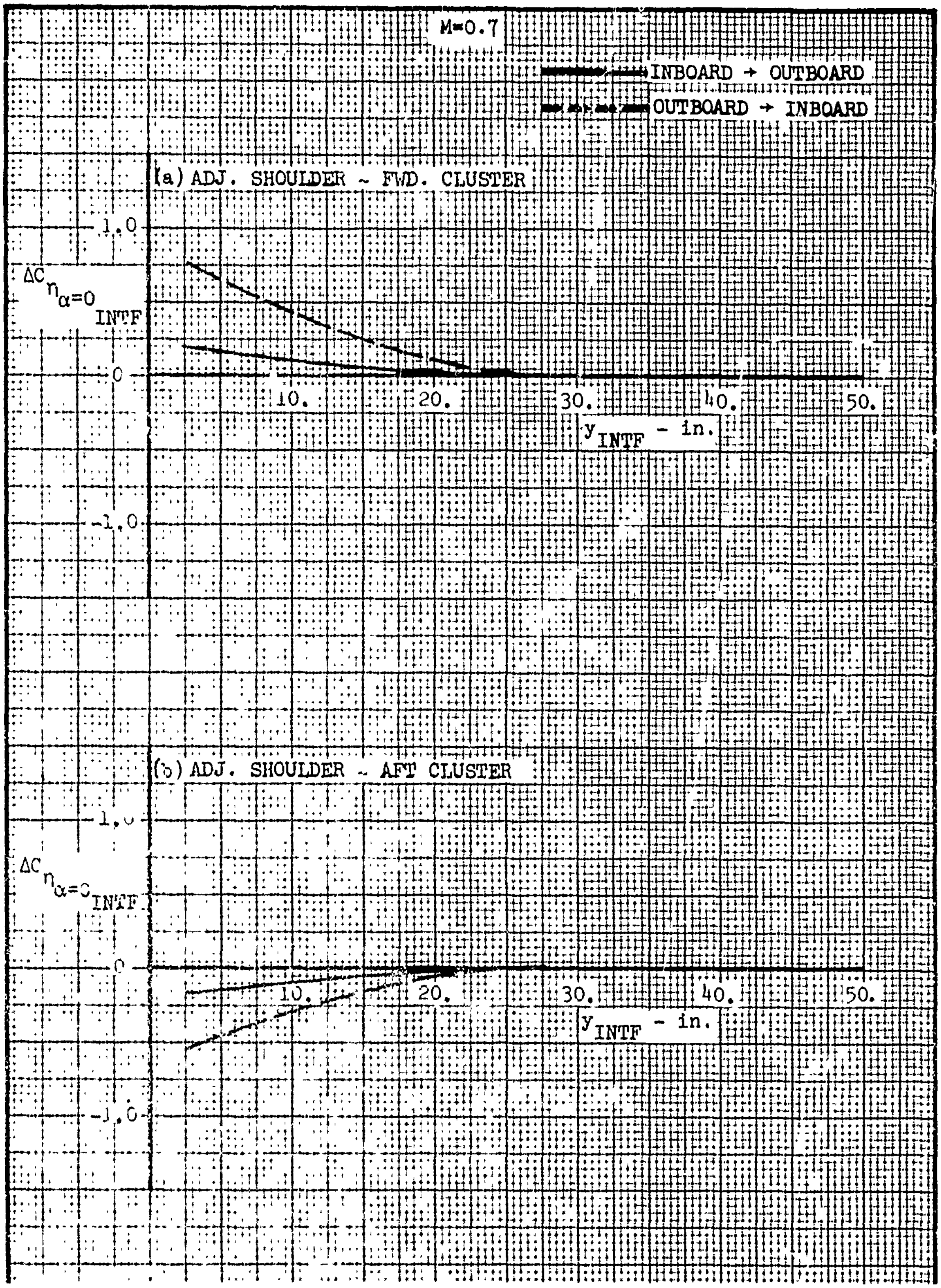



Figure 51c Incremental Yawing Moment Intercept Due to Interference - Adjacent Shoulder at M = 0.7

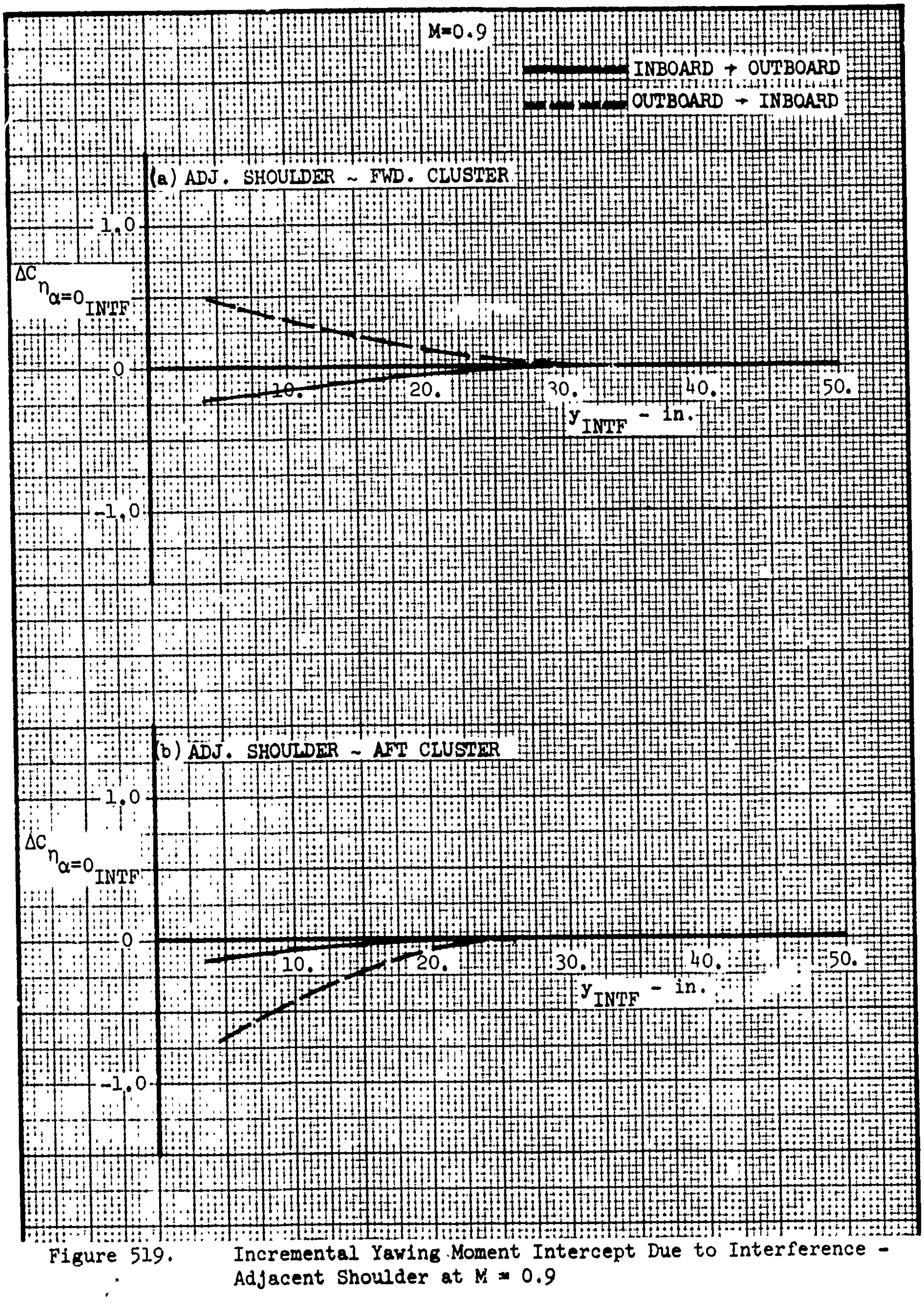



Figure 519. Incremental Yawing Moment Intercept Due to Interference - Adjacent Shoulder at M = 0.9

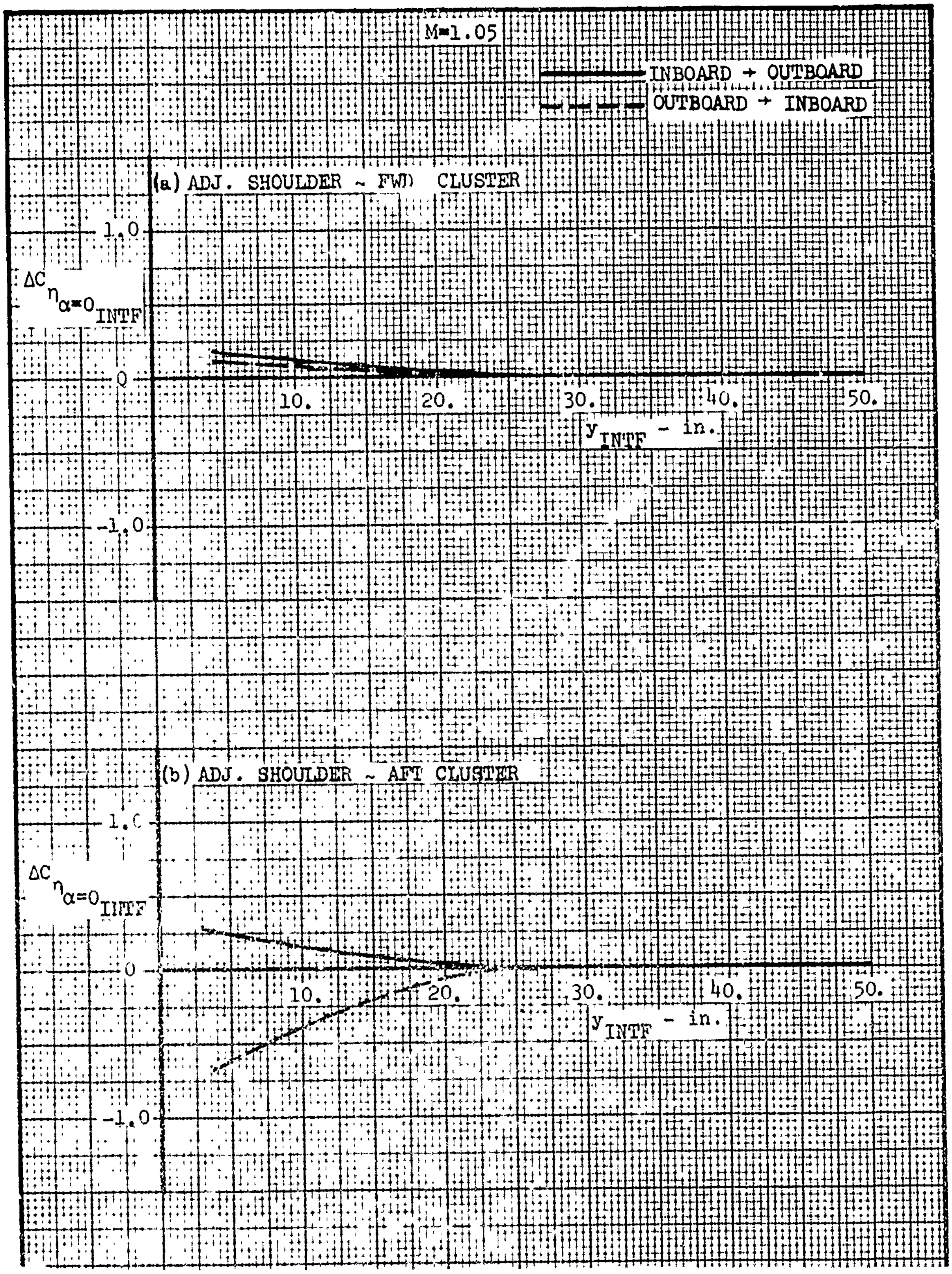



Figure 540. Incremental Yawing Moment Intercept Due to Interference - Adjacent Shoulder @ M - 1.05

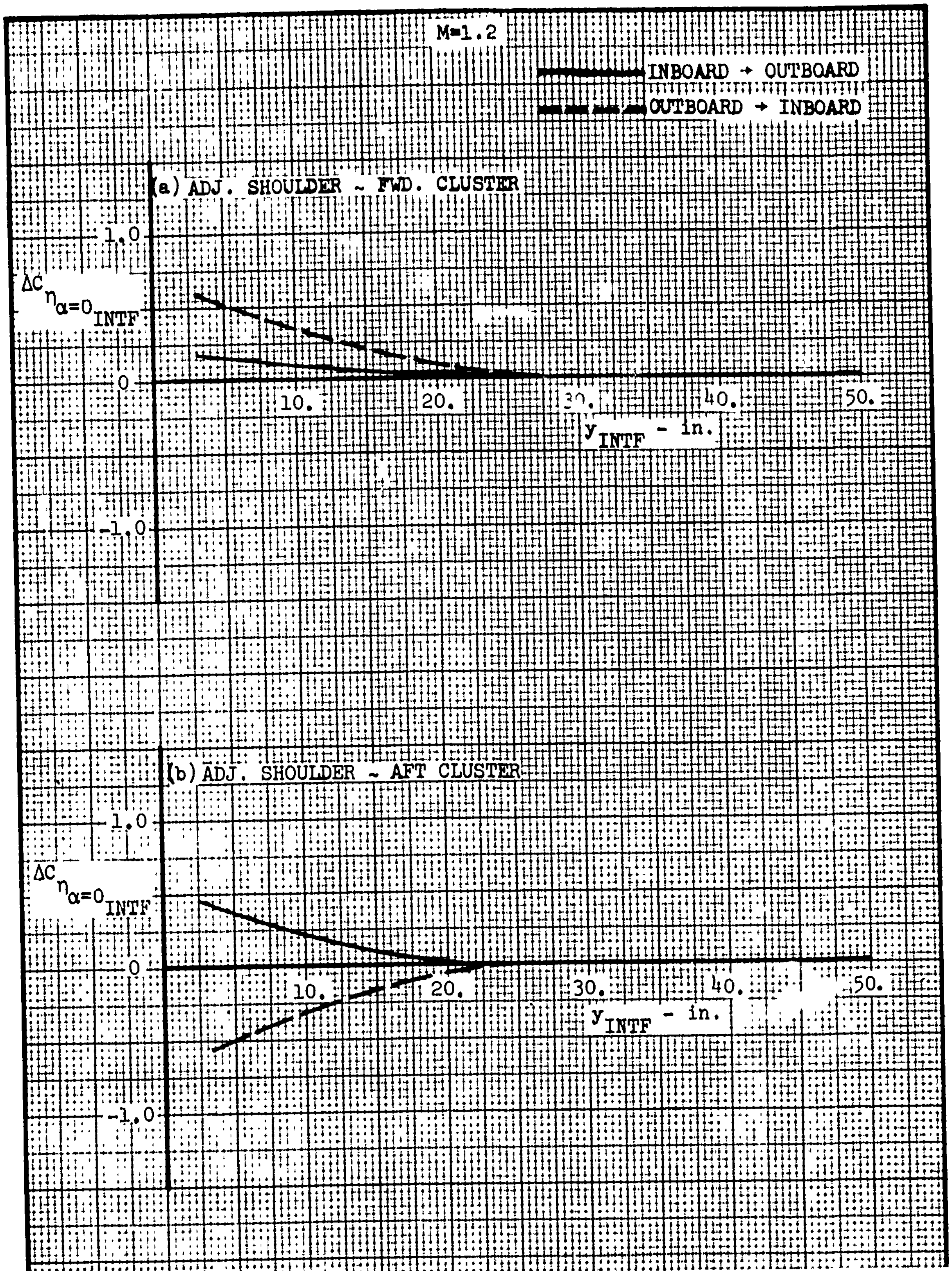



Figure 521. Incremental Yawing Moment Intercept Due to Interference - Adjacent Shoulder at M = 1.2

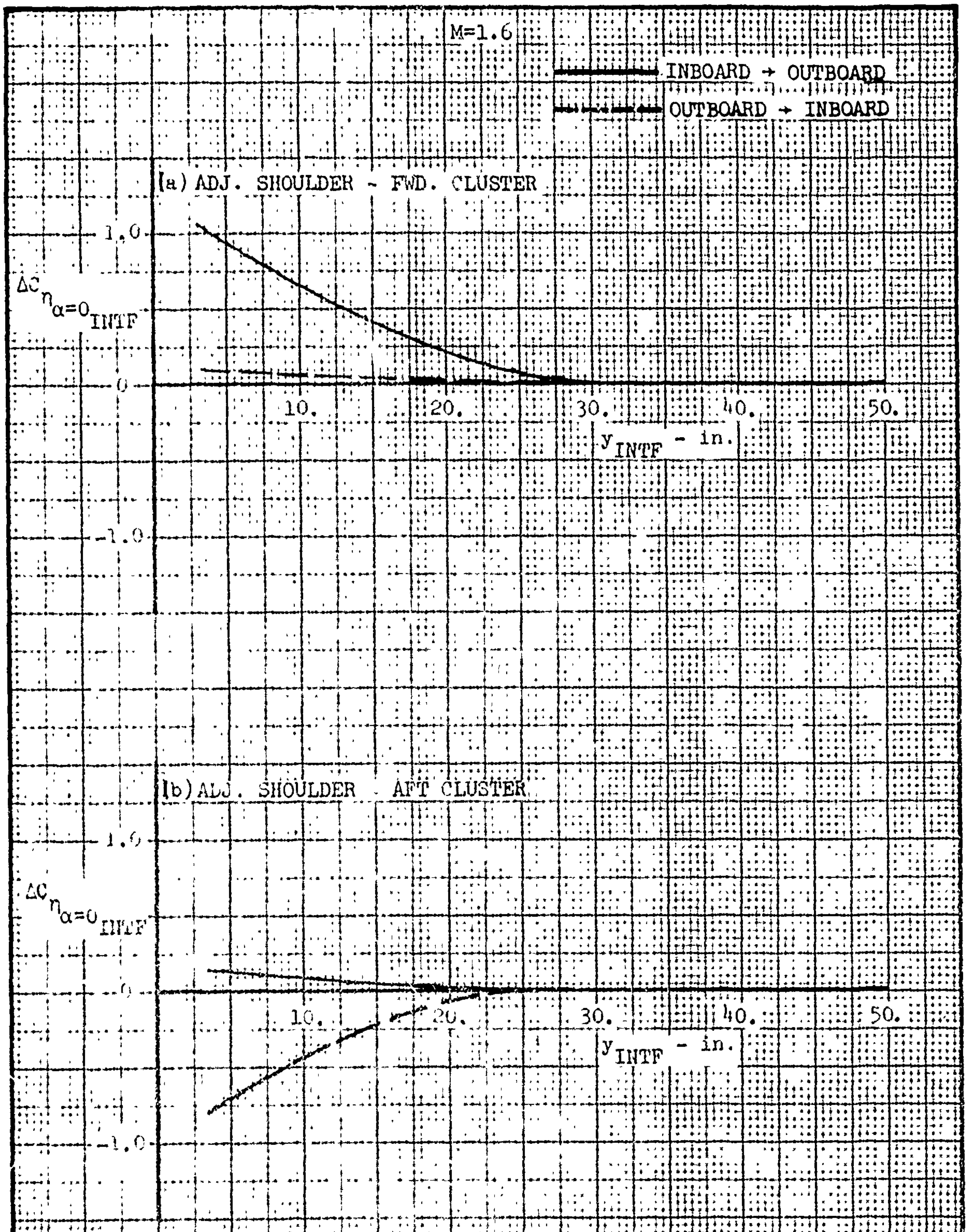



Figure 9?   Incremental Yawing Moment Intercept Due to Interference - Adjacent Shoulder at M = 1.6

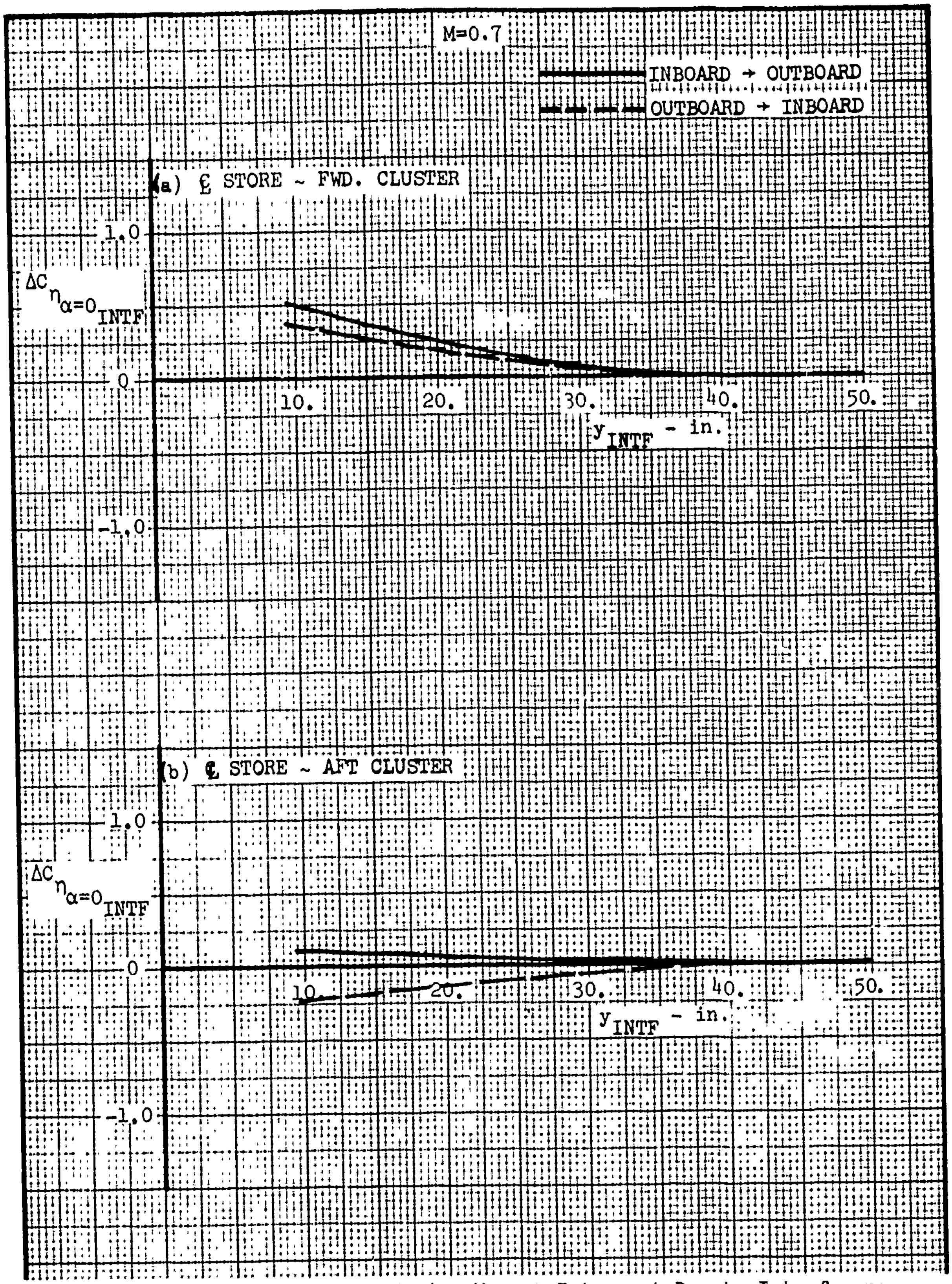



Figure 523. Incremental Yawing Moment Intercept Due to Interference - Centerline Store at M = 0.7

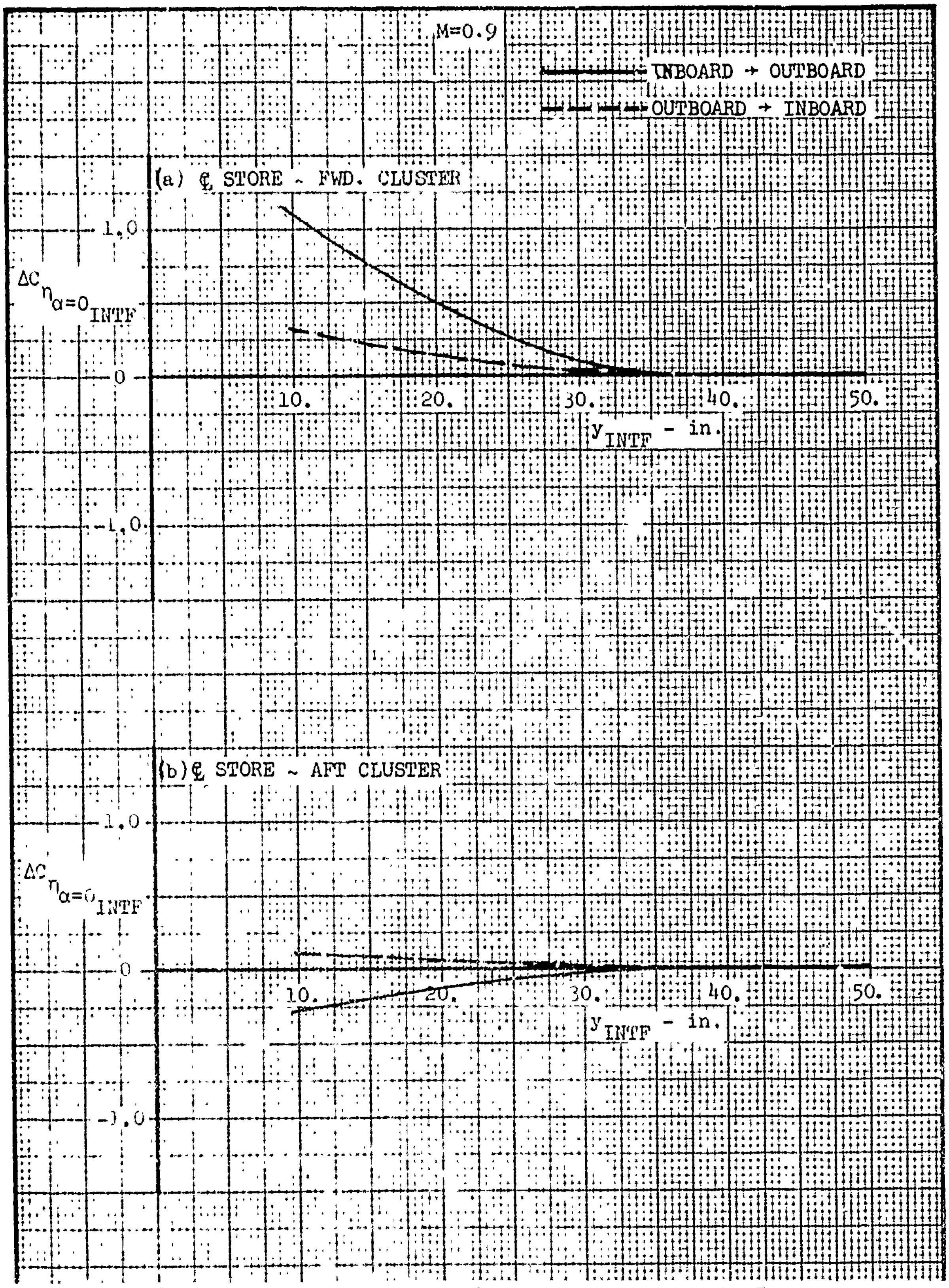



Figure 524. Incremental Yawing Moment Intercept Due to Interference - Centerline Store at M = 0.9

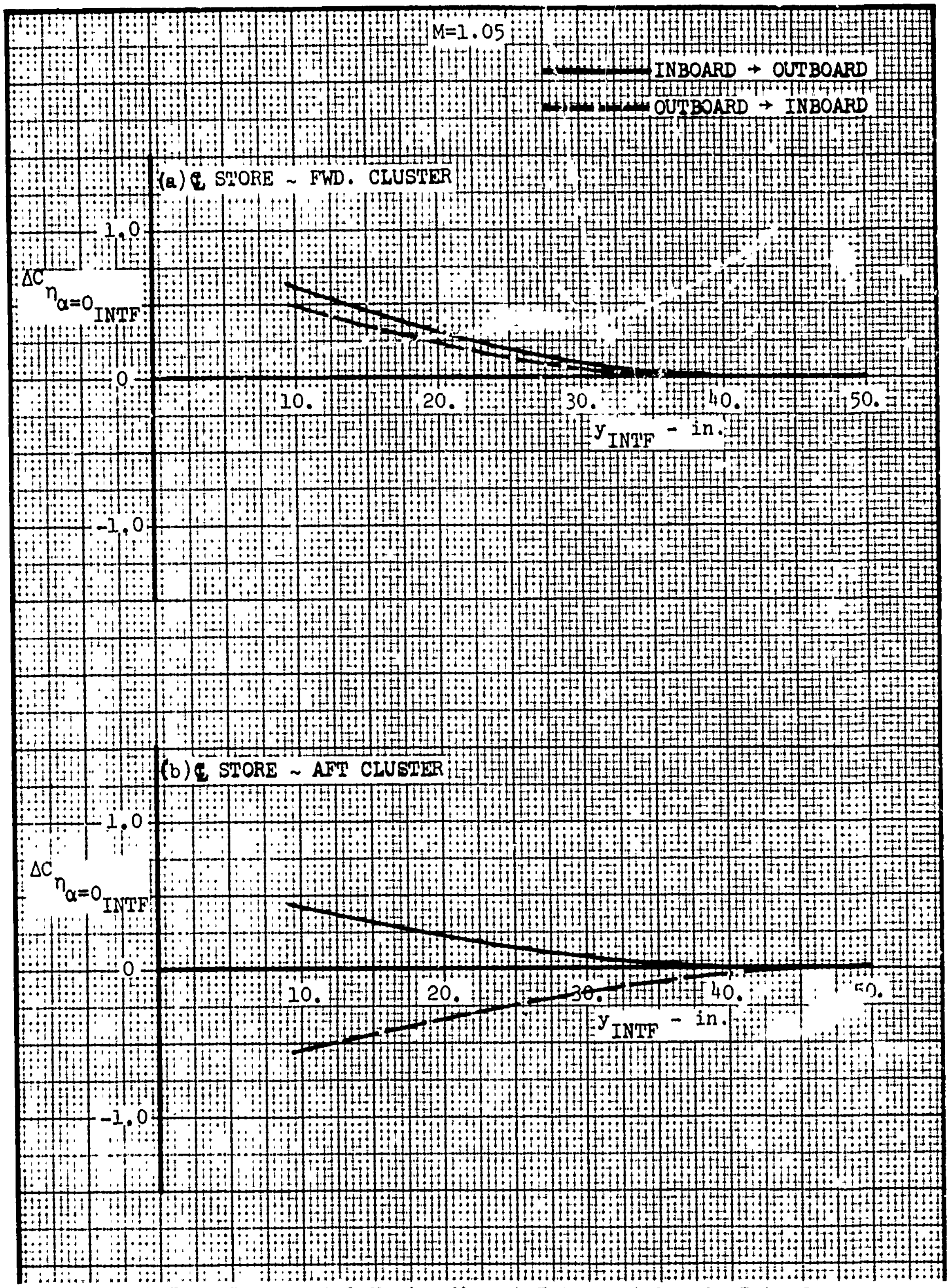



Figure 525. Incremental Yawing Moment Intercept Due to Interference - Centerline Store at M = 1.05

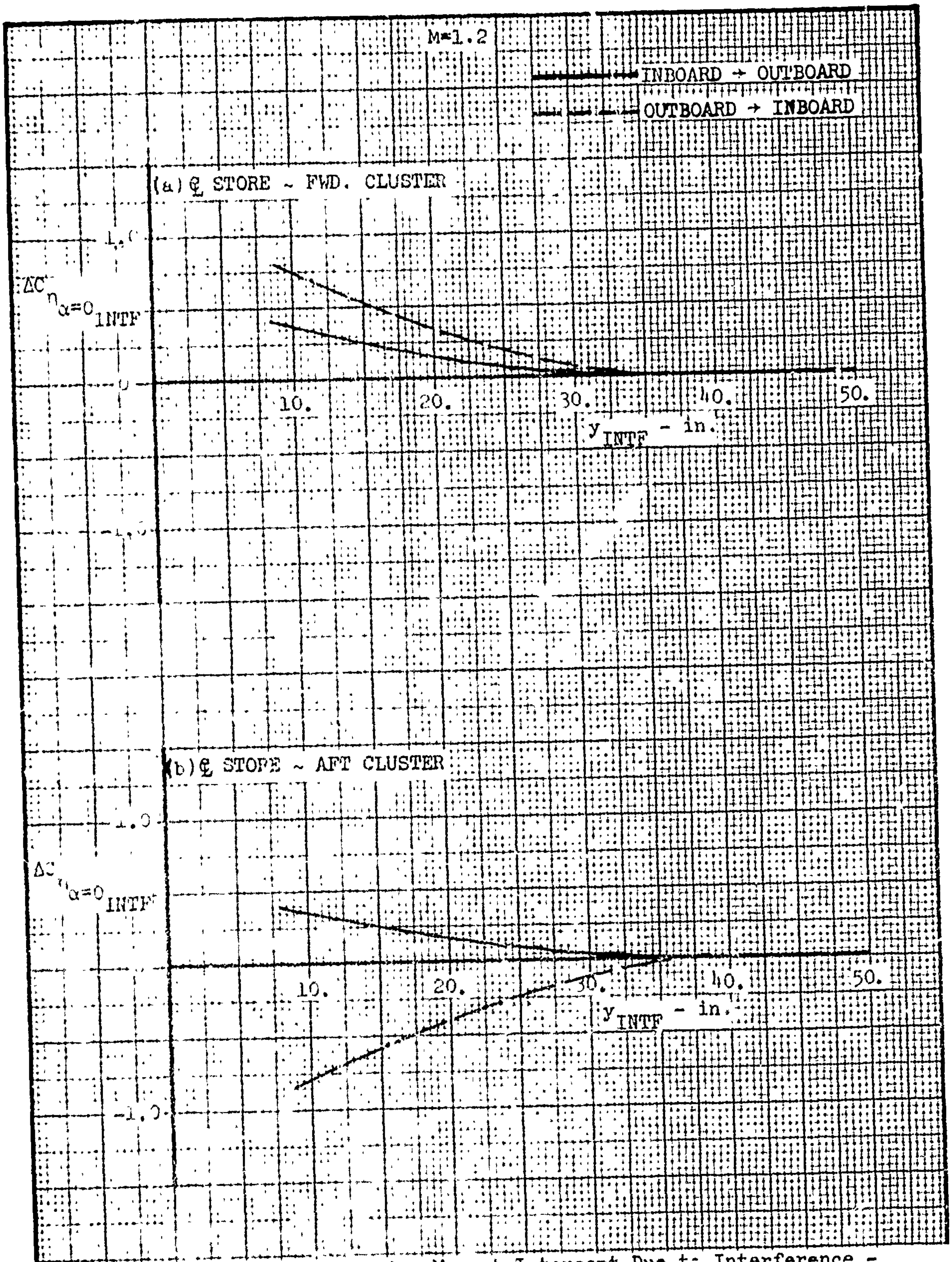



Figure 56 Incremental Yawing Moment Intercept Due to Interference - Centerline Store at M=1.2.

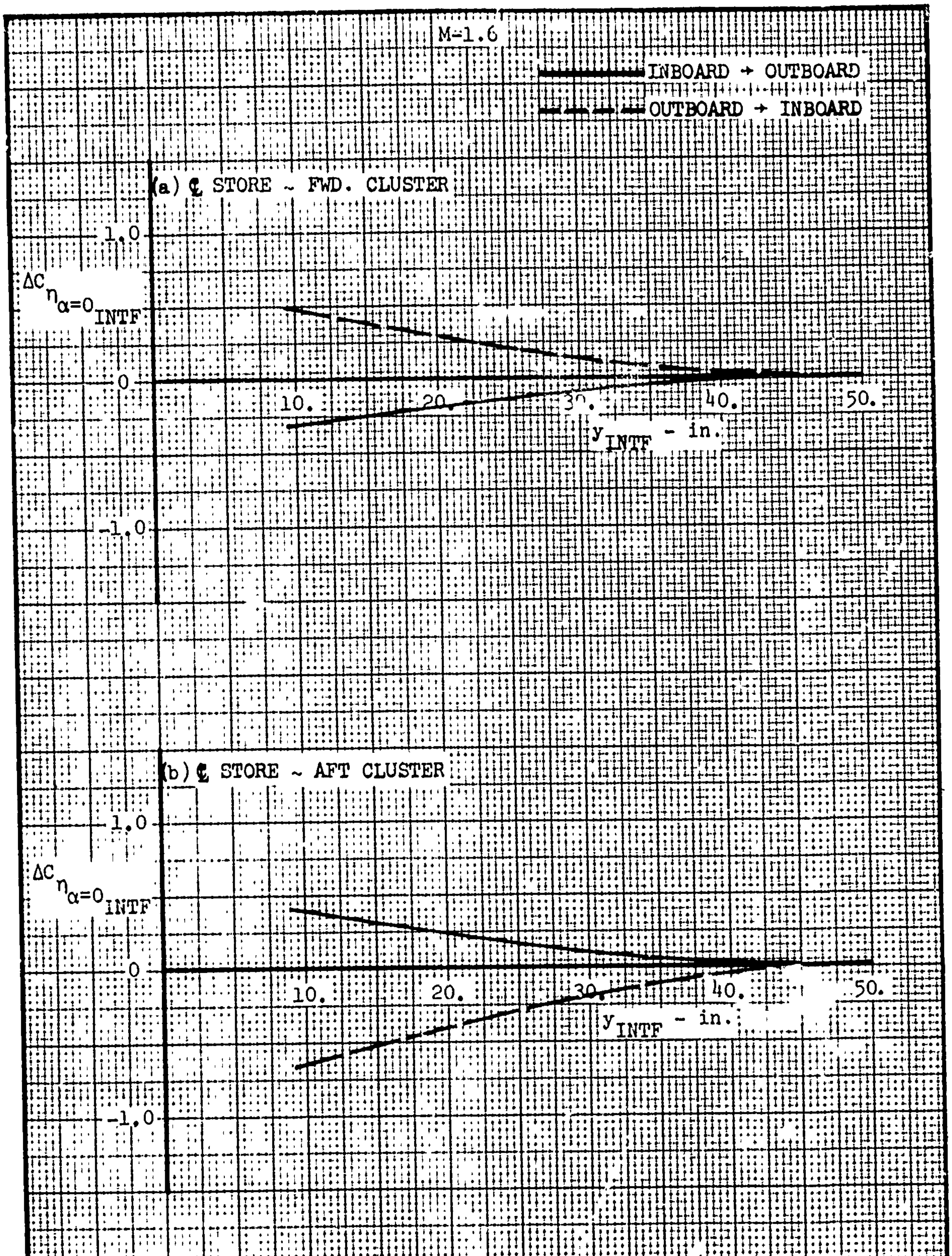



Figure 527. Incremental Yawing Moment Intercept Due to Interference - Centerline Store at M=1.6

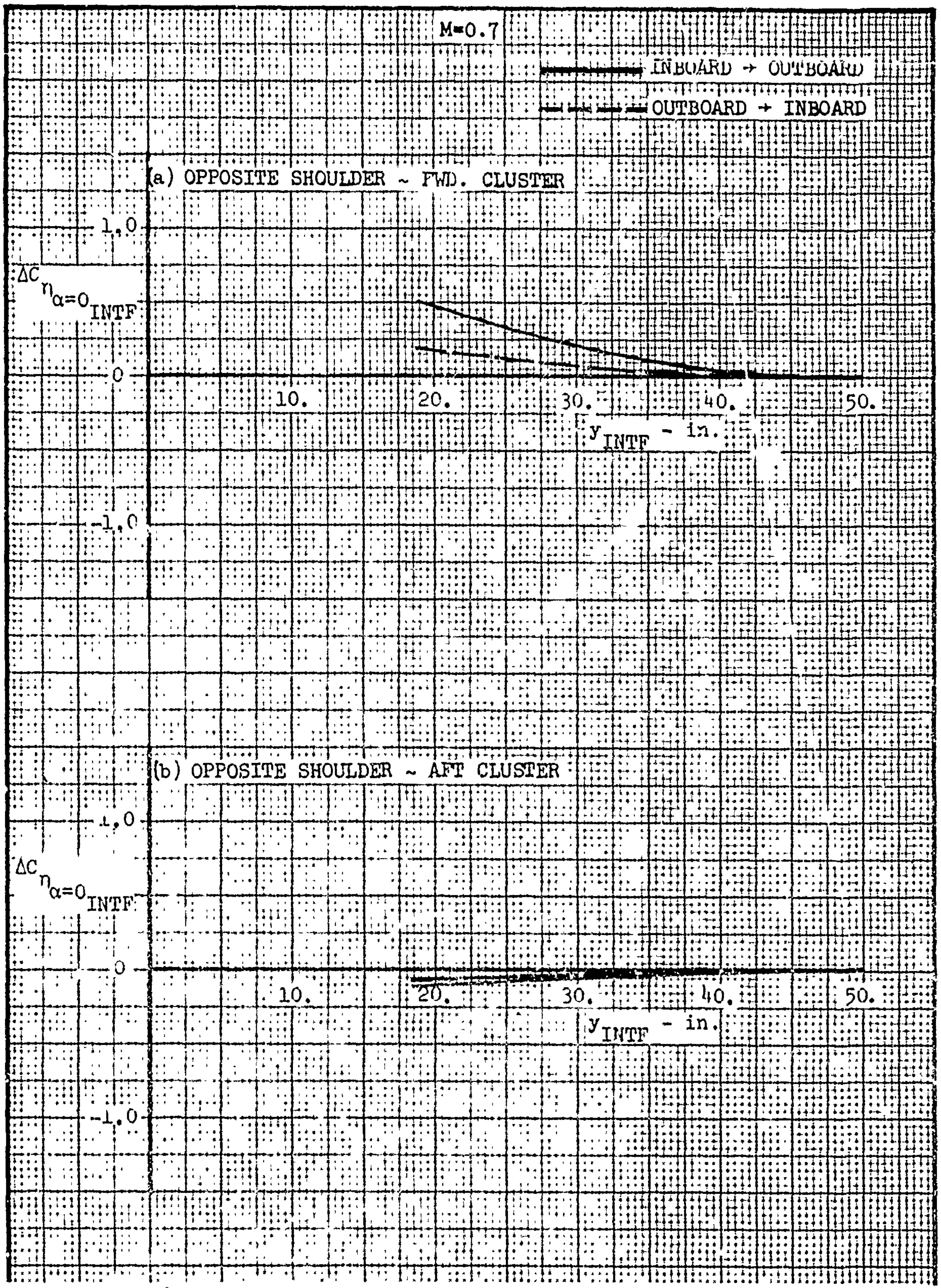



Figure 528. Incremental Yawing Moment Intercept Due to Interference - Opposite Shoulder at M = 0.7

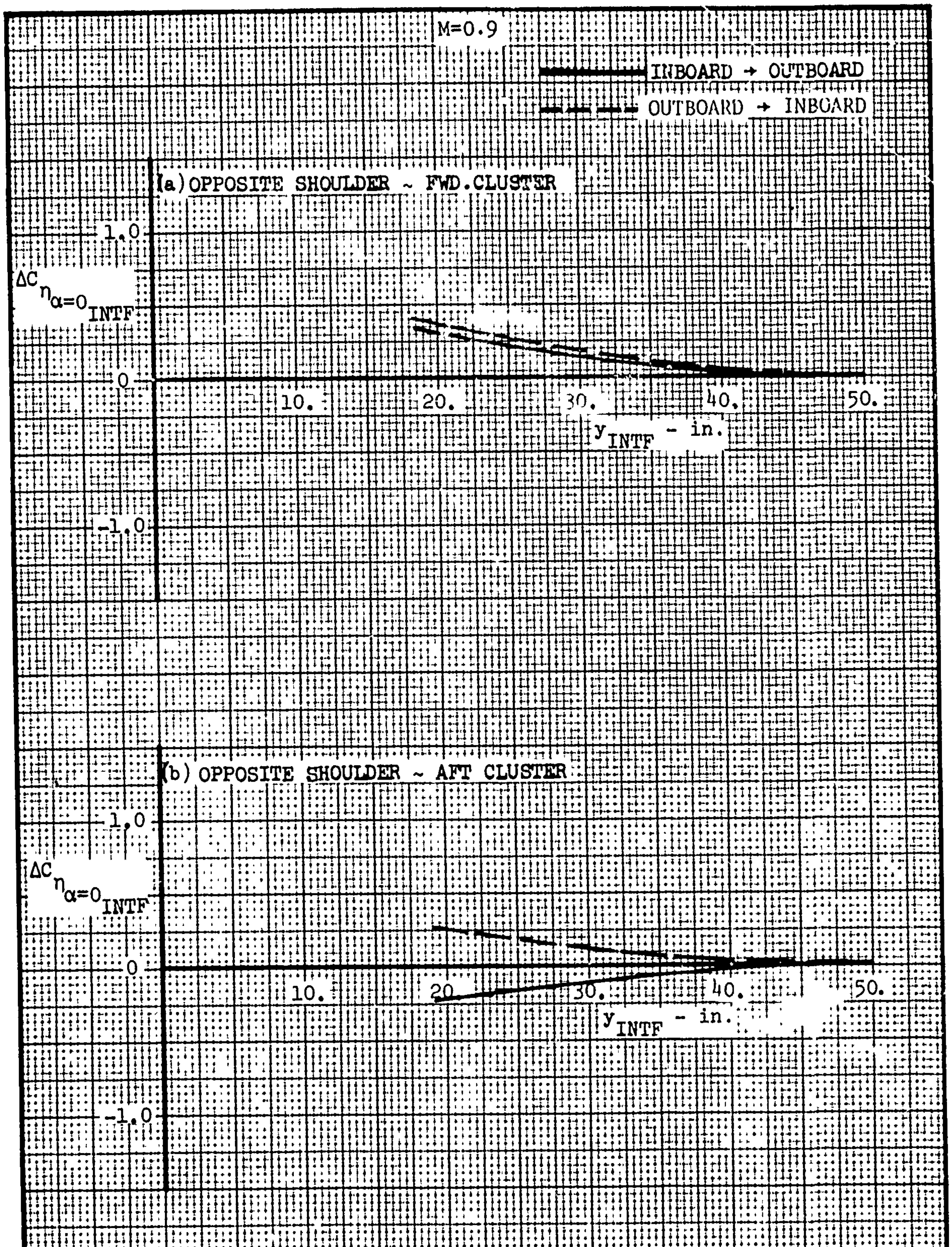



Figure 529. Incremental Yawing Moment Intercept Due to Interference - Opposite Shoulder at M = 0.9

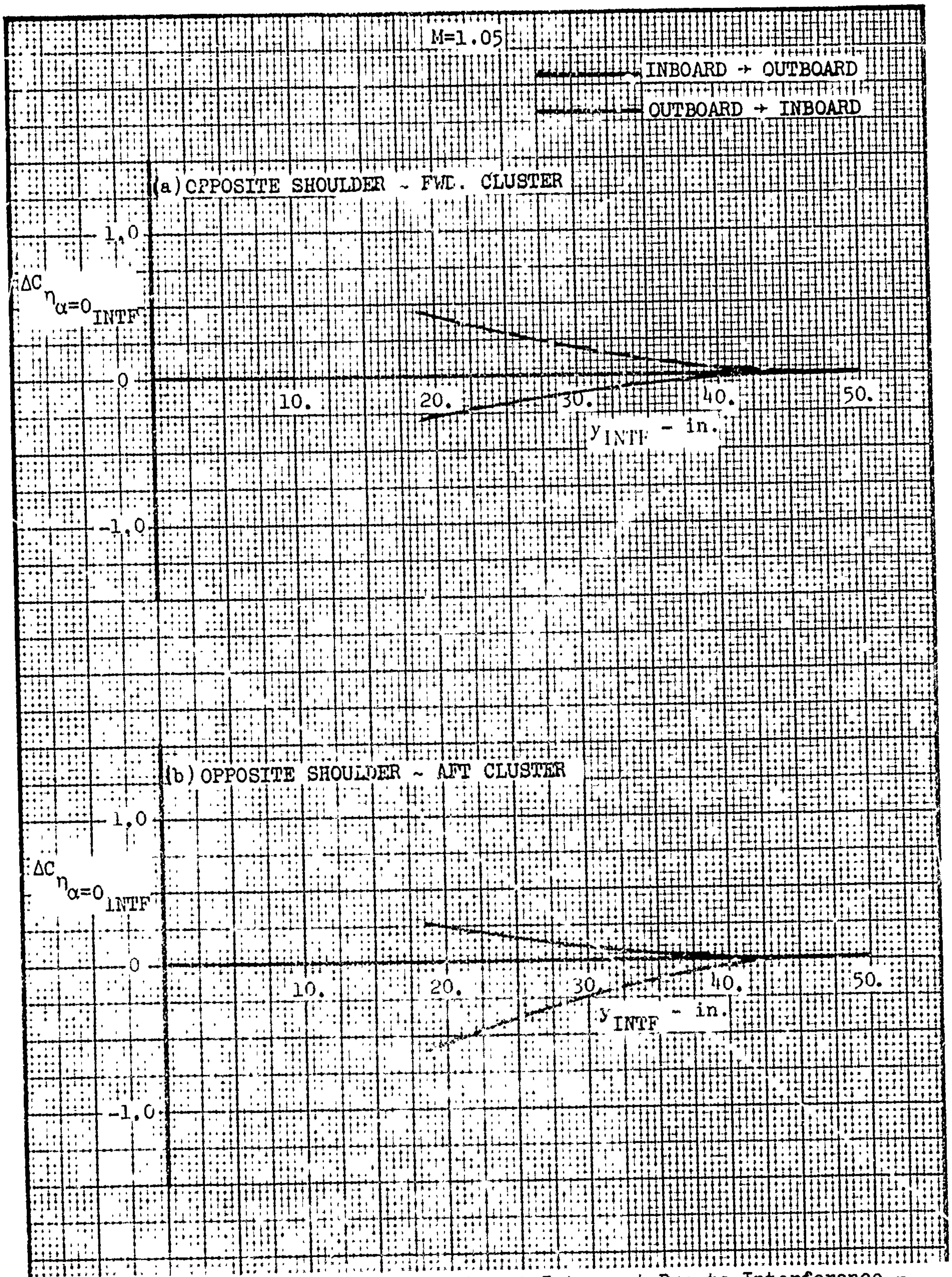



Figure 330. Incremental Yawing Moment Intercept Due to Interference - Opposite Shoulder at M = 1.05

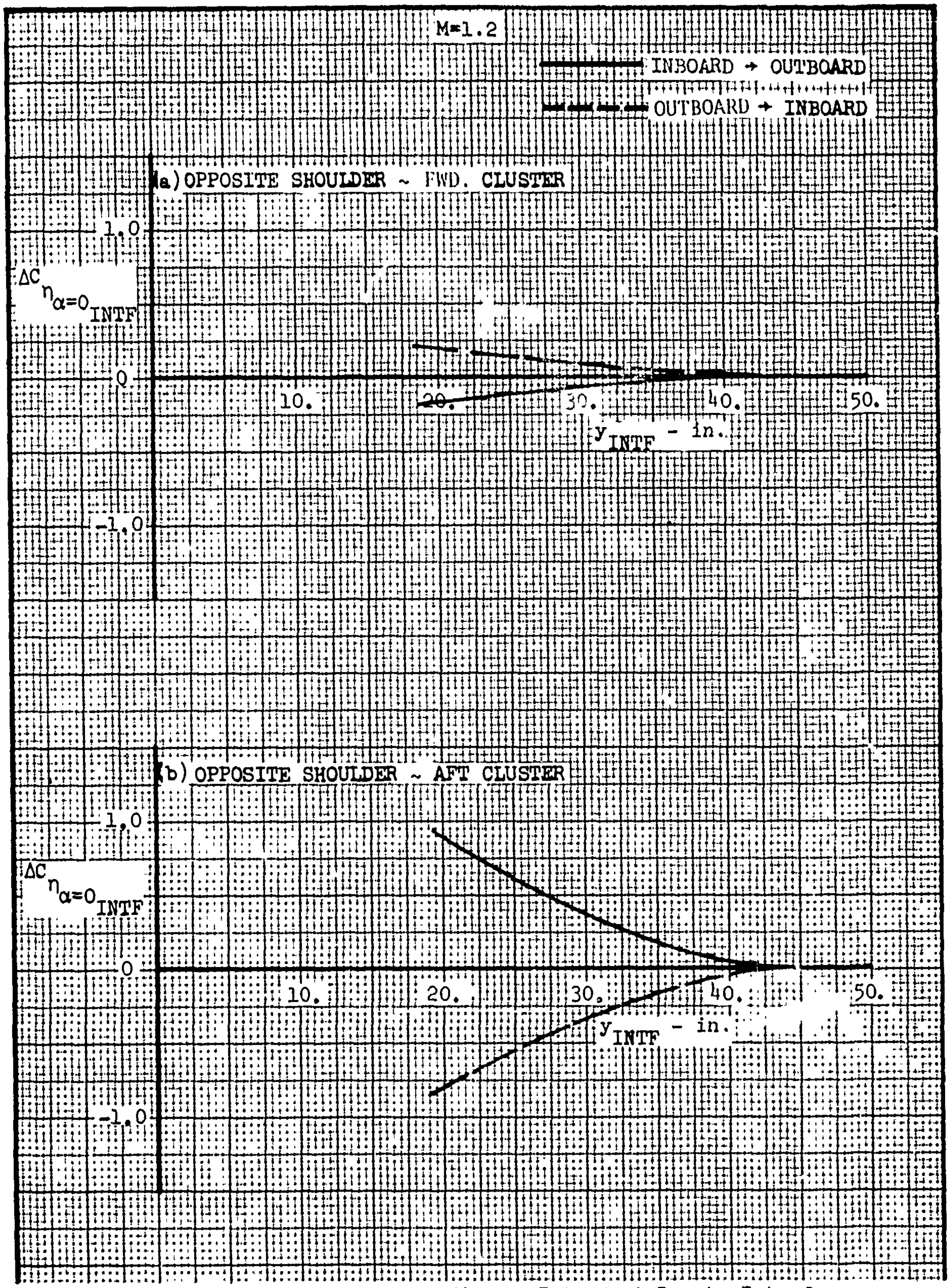



Figure 531. Incremental Yawing Moment Intercept Due to Interference - Opposite Shoulder at M = 1.2

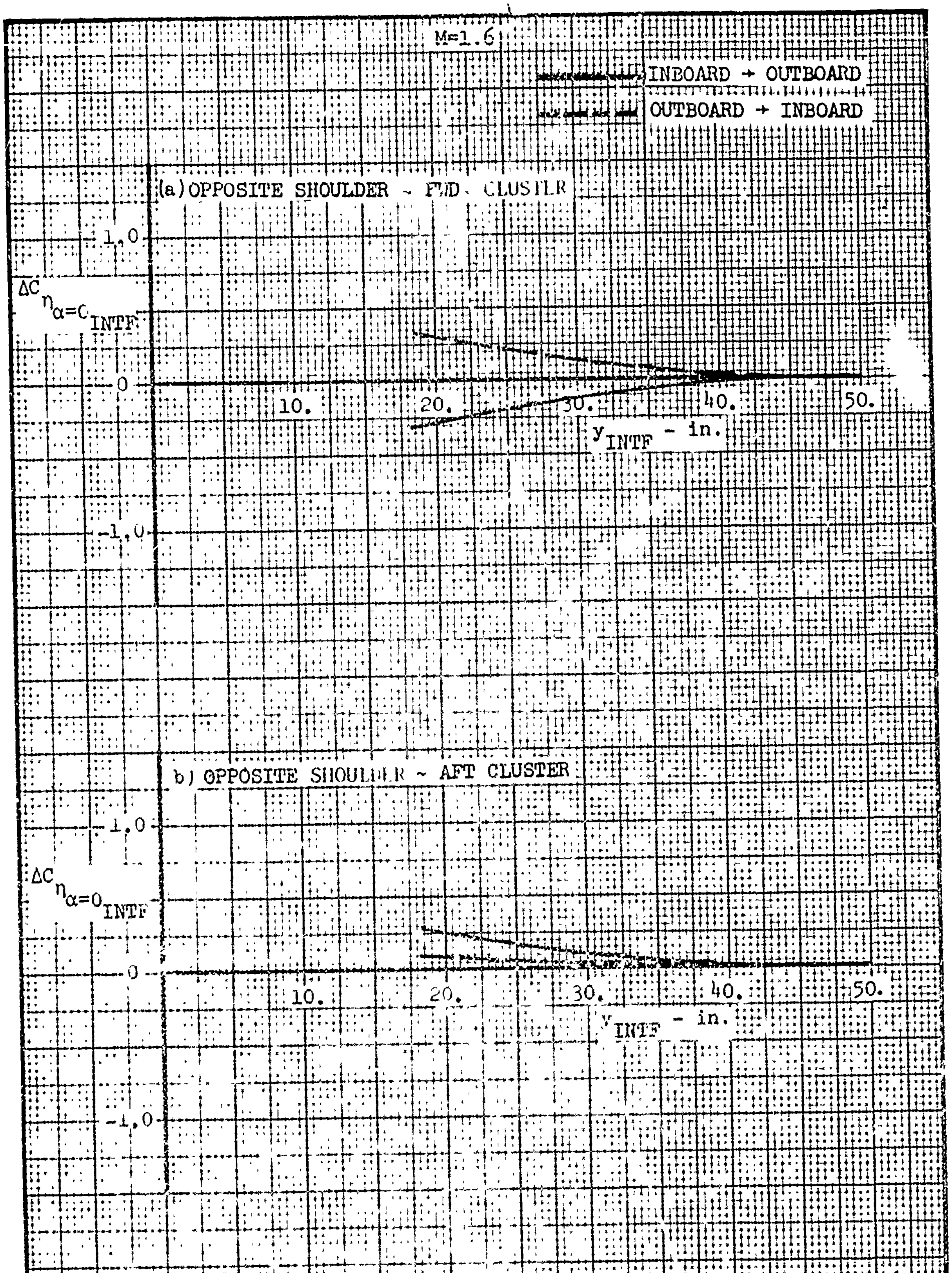



Figure 53. Incremental Yawing Moment Intercept Due to Interference - Opposite Shoulder at M = 1.6

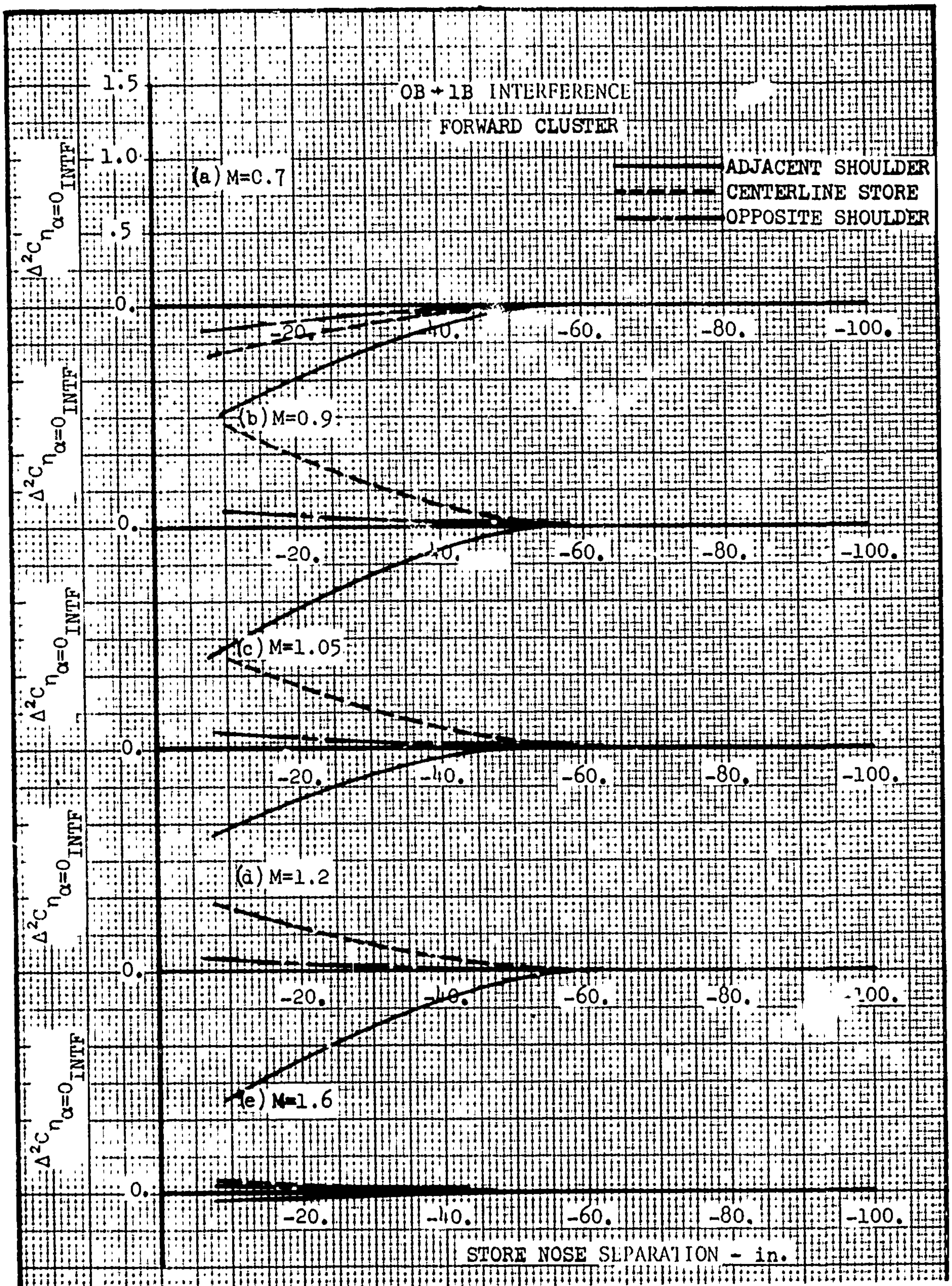



Figure 533. Incremental Yawing Moment Intercept Due to Interference - Outbd. to Inbd. Interference Correction for the Forward Cluster

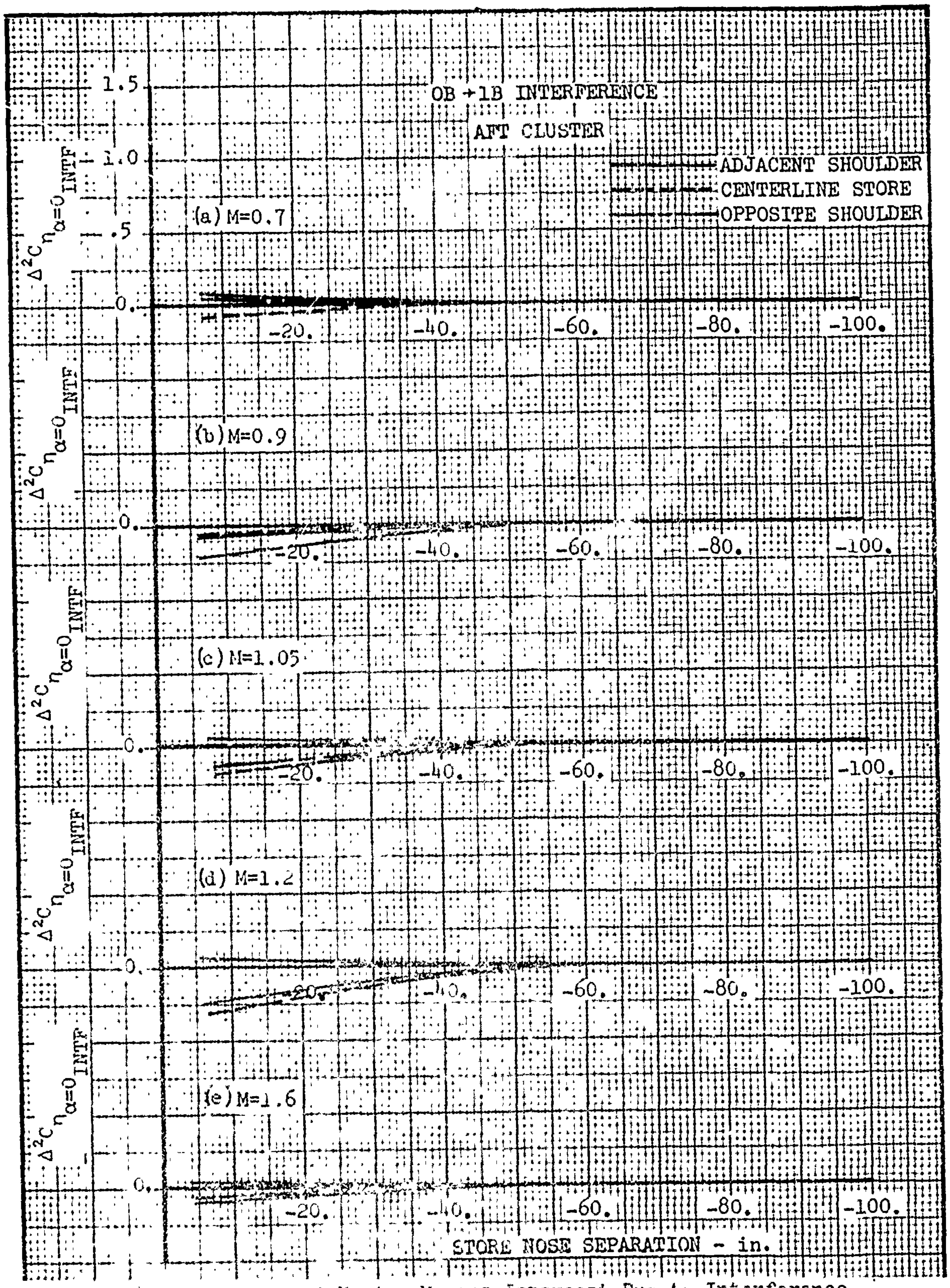



Figure 34. Incremental Yawing Moment Intercept Due to Interference - Outboard to Inboard Interference Correction for the Aft Cluster

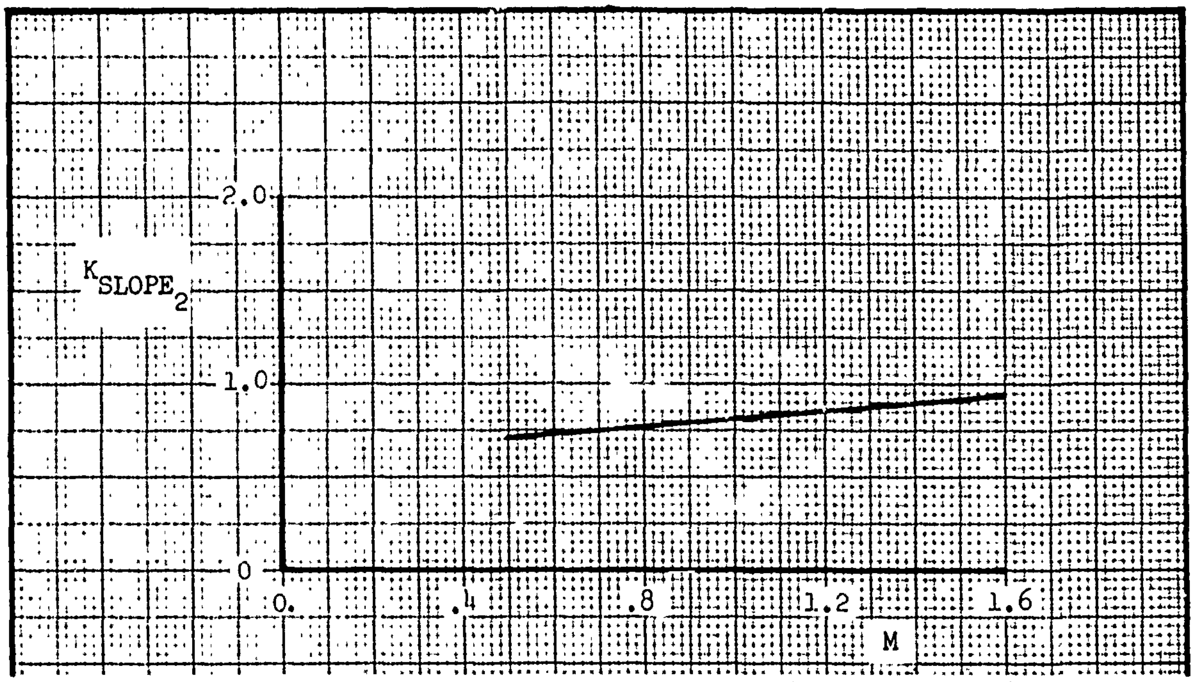



Figure 535. Incremental Yawing Moment Intercept Due to Interference - $K_{SLOPE_2}$ for Combination Inboard and Outboard Interference

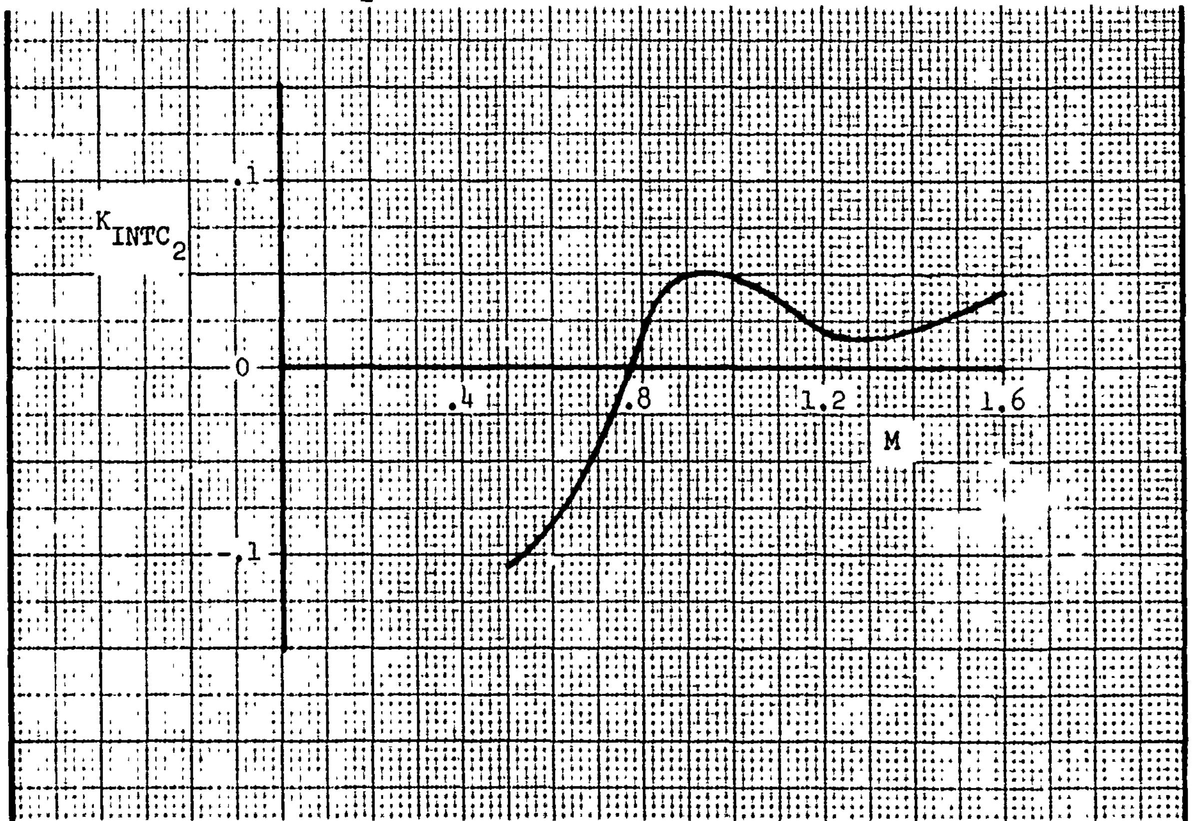



Figure 536. Incremental Yawing Moment Intercept Due to Interference - $K_{INTC_2}$ for Combination Inboard and Outboard Interference



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